MONTHLY WEATHER REVIEW,

APRIL, 1880.

(General Weather Service of the United States.)

WAR DEPARTMENT,

Office of the Chief Signal Officer,

DIVISION OF

TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

INTRODUCTION.

In preparing this REVIEW the following data, received up to May 13th, have been used, viz: the regular tri-daily weather charts, containing the data of simultaneous observations taken at 139 Signal Service stations and 14 Canadian stations, as telegraphed to this office; 138 monthly journals and 159 monthly means from the former, and 14 monthly means from the latter; reports from 27 Sunset stations; 225 monthly registers from Voluntary Observers; 39 monthly registers from United States Army Post Surgeons; Marine Records; International Simultaneous Observations; monthly reports from Voluntary Observers in, and the local Weather Service of, Missouri; reliable newspaper extracts; special reports.

BAROMETRIC PRESSURE.

Barometric Pressure.—As compared with the means for the preceding eight years, the pressure for April, 1880, east of the Rocky Mountains, shows a marked deficiency in Iowa, Minnesota and the Upper Lake region, with a corresponding excess over the Middle Atlantic, South Atlantic and East Gulf States, Tennessee and along the coast of New England. The greatest excess is reported from Augusta, Georgia, 0.12 inch above the mean, and the most marked deficiency prevailed at St. Paul, Minn., .08 below the mean. On the Pacific coast region, as compared with the preceding three years, a marked deficiency, ranging from .02 to .09, is reported from Oregon and Washington Territory, while in California an excess prevailed, ranging from .02 at Red Bluff to 0.11 at San Diego.

Local Barometric Ranges.—East of the Rocky Mountains the barometric ranges for April, 1880, increase gradually from the Florida Peninsula northwestward to the States of Nebraska, Iowa, Minnesota. Ranges exceeding one inch occurred in the Upper Lake region, the Upper Mississippi and Lower Missouri valleys, and the eastern Rocky Mountain Slope from central Texas northward to Dakota. The minimum ranges were 0.35 inch at Key West, 0.40 at Punta Rassa, and the maximum ranges 1.54 at North Platte and Marquette, 1.65 at Omaha and 1.89 at Duluth. On the Pacific coast the ranges regularly increased northward; maximum range 1.20 at Umatilla.

Areas of High Pressure.—Eleven areas of high pressure have appeared during *April* within the limits of the Signal Service maps. Three areas only are of interest:—No. II which, in connection with low area No. II, produced the very heavy rains, from the 2nd to the 4th, on the Pacific coast; No. IV which was marked by the severe frost in the Southern States from the 9th to 12th; No. VIII which, developing on the Pacific coast, passed eastward to the Atlantic coast and was marked by the unusually cold weather from April 29th to May 1st.

No. I.—This area, covering the Ohio valley and the Atlantic States during the 1st, withdrew slowly northeastward and dissipated during the 4th in the Canadian maritime provinces. The highest pressure was reported from Halifax the morning of the 3rd; barometer 30.47, or 0.70 above the normal. During the 2nd, brisk winds being reported, Cautionary Signals were ordered from Fort Macon northward to Sandy Hook.

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These signals were fully justified in connection with this area and were continued, in connection with low area No. I, until the 5th; maximum velocities: SW. 36 at Kittyhawk, Capes Lookout and Hatteras; S. 46 at Delaware Breakwater.

No. II.—During the 3rd the pressure rose rapidly on the Pacific coast; midnight barometer at Los Angeles, 0.24 above the normal. The centre of high pressure gradually moved northward, and on the afternoon of the 5th the highest pressure was reported from Umatilla, 0.47 above the normal. The highest pressure remained substantially unchanged over Oregon until the 7th, when it withdrew eastward over the Northern Plateau district and gradually dissipated on the 9th, in advance of low area No. V. In connection with this area and low area No. II, exceedingly heavy storms of rain on the coast and snow in the interior, continued from the morning of the 1st until midnight of the 4th. During the 1st and 2nd the rains were specially heavy, more than two inches, within twenty-four hours, being reported from many places in California.

No. III.—During the night of the 5th the pressure rose rapidly in the entire Missouri valley. By the afternoon of the 6th Bismarck barometer was 0.54 above the normal. Moving slowly southeastward, the highest pressure, the afternoon of the 7th, was at Leavenworth, and on the morning of the 8th at Fort Sill, where the barometer was 0.56 above the normal. At that time the entire country, except Sydney, C. B., was covered by a pressure above the normal. The afternoon of the 8th the highest pressure of the area was reported from Eagle Pass, 0.63 above the normal. The highest pressure remained unchanged in southern Texas until the 11th, when it gradually dissipated. The signals in the Lake region, in connection with this area, are treated of in the description of low area No. I. The Cautionary Off-shore Signals, displayed on the Texas coast, from midnight of the 6th until the afternoon of the 8th, were fully justified by northerly winds of 36 miles at Galveston, and 49 at Indianola. A north wind of 26 miles is also reported from the Eastern Gulf, at Cedar Keys, on the 8th.

No. IV.—As low pressure No. IV moved eastward it was followed by this area. Central in the Upper Missouri valley on the morning of the 10th, it moved slowly southeastward to the Ohio valley, where the highest pressure of the area was reported from Cairo, on the morning of the 12th, 0.48 above the normal. Moving thence nearly eastward it withdrew slowly, during the 14th, from the Carolina coast over the Atlantic ocean. On the morning of the 11th, the isotherm of 32° minimum temperatures passed to the south, ward of the Lake region, the Ohio and the greater part of the Upper Mississippi and Lower Missouri valleys. and on the morning of the 12th passed to the southward of east Tennessee and the interior of North Carolina. Serious and numerous frosts were reported from the 9th to the 12th, as far south as parallel 33°. The minimum temperatures of the month were reported in connection with this area. The signals in the Upper Lake region, during the 10th, are treated in connection with low area No. IV. During that date Cautionary Off-shore Signals were ordered from Smithville to Cape Lookout and the signals from Eastport to Cape Hatteras were changed to Off-shore. These signals were lowered on the New England coast during the 11th, and on the New Jersey and North Carolina coasts during the 12th, having been fully justified; maximum velocities: Portland, NW. 26; Sandy Hook, NW. 40; Cape Henry, NW. 43; Delaware Breakwater, NW. 44.

No. V.—During the 15th an area of slight importance appeared over the province of Ontario and by the morning of the 17th had withdrawn northeastward over the Gulf of St. Lawrence. In the afternoon of the 15th Cautionary Off-shore Signals were ordered from Sandy Hook southward to Chincoteague. These signals were partly justified by velocities of SW. 28 at Delaware Breakwater and SW. 32 at Chincoteague.

No. VI.—During the 18th and 19th an area covered the greater part of California, but dissipated on the latter date in advance of low area No. XII.

No. VII.—This area developing in the Ohio valley during the night of the 16th had moved northeastward to the Lower St. Lawrence by the afternoon of the 18th. Extending from Connecticut northeastward to Nova Scotia it remained substantially unchanged until the 22nd when it withdrew eastward over the Atlantic Ocean. On the morning of the 17th the Cautionary Signals displayed in connection with low area No. VIII were changed along the Atlantic coast to Off-shore, and were lowered that afternoon, having been fully justified; maximum velocities: NW. 36 at Sandy Hook and Chincoteague; NW. 38 at Delaware Breakwater.

No. VIII.—This area appeared in northern Texas the morning of the 19th and moving eastward to the Middle Atlantic coast united with area No. VII. on the 20th and withdrew eastward over the Atlantic Ocean on the 22nd. Cautionary Off-shore Signals were ordered on the morning of the 19th for the Western Gulf and were lowered at midnight, having been justified by velocities of N. 27 at Galveston and N. 41 at Indianola. On the Atlantic coast, brisk winds having been reported, Off-shore Signals were ordered at noon of the 20th from Sandy Hook southward to Kittyhawk, and were lowered later in the day, having been but partly justified; maximum velocity: N. 32 at Delaware Breakwater.

No. IX.—The pressure increasing on the Pacific coast during the 22nd, the barometer at Olympia the afternoon of the 23rd was 0.34 above the normal. The pressure remained unchanged until the 27th, when it withdrew eastward over the Northern Plateau district, where, on the afternoon of the 28th, the Virginia City barometer was 0.32 above the normal. On the morning of the 29th the highest pressure was at Deadwood, 0.35 above the normal. Its course thence was southward to Texas, where the highest pressure of the

area prevailed during the 30th, Fort Sill barometer that afternoon 0.60 above the normal. At midnight of the 30th the area was gradually moving east, with diminishing pressure. The passage of this area was marked by unusually low temperatures for the season. On the morning of the 30th the isotherm of 32° minimum temperatures passed to the southward of the greater part of the Upper Lake region, the Missouri valley and the Rocky Mountain slope as far south as northwestern Texas; at midnight freezing temperatures were reported from the Lower Lake region and from the interior of New York and New England. On the morning of the 29th Cautionary Off-shore Signals were displayed on the Texas coast and were lowered that afternoon, justified as to velocity, but not as to direction. During the 30th the Cautionary Signals from Cape Hatteras to Eastport were changed to Off-shore. These signals were lowered on the 1st of May, having been justified, except on portions of the Maine and North Carolina coasts; maximum velocities: N. 28 at Cape Lookout; NW. 44 at Sandy Hook and Cape Henry; W. 32 at Boston.

No. X.—On the 22nd this area appeared over the Upper Lake region. On the morning of the 23rd the highest pressure was reported from Rockliffe—0.42 above the normal. This area remained over the Canadian Maritime provinces from the 24th to the 25th on which date it gradually dissipated. On the 22nd Cautionary Signals were ordered for Lakes Erie and Ontario in the morning, and for the Upper Lake region in connection with advancing low area No. XIII, at midnight. The signals for the entire Lake region—generally justified—were continued until the 25th, and are discussed in the low area above mentioned. In the morning of the 23rd Cautionary Signals were displayed from Eastport to Chincoteague, and during the afternoon southward to Fort Macon. These signals were lowered that afternoon in New England, (not justified,) but were continued on the Middle Atlantic and Carolina coast until the 25th, and were fully justified; maximum velocities: Delaware Breakwater, NE. 36; Kittyhawk, S. 36; Sandy Hook, E. 42.

No. XI.—This area appeared in Indian Territory the morning of the 26th, and moving northeastward prevailed in the Ohio valley during the 27th. Central on the Middle Atlantic coast during the 28th, it extended northward during the night and on the morning of the 29th the highest pressure of the area prevailed at Halifax—barometer 0.67 above the normal. During the 30th it withdrew eastward or dissipated in advance of low area No. XV. On the morning of the 27th Cautionary Off-shore Signals were ordered for the Texas coast and were lowered that afternoon, not justified. At midnight of the 26th Off-shore Signals were ordered from Cape Hatteras to Wood's Holl and on the following morning thence northward to Portland. These signals were lowered during the 27th, having been fully justified; maximum velocities: Portland, NW. 26; Cape Hatteras, NW. 29; Sandy Hook and Delaware Breakwater, NW. 34.

Areas of Low Pressure.—During the month of *April*, 1880, fourteen areas have been charted on the Signal Service Weather Maps. Six of these first appeared on the Pacific coast north of California; four developed on the Eastern Slope of the Rocky mountains; three came from Manitoba or Saskatchewan, and one developed in the Lower Mississippi valley. The areas of most marked interest are Nos. X and XIII. During the passage of No. X occurred the violent storms of the 18th, in Arkansas, Missouri, Iowa and Illinois. In connection with area No. XIII occurred the violent rain and snow-storms on the Pacific coast during the 20th and 21st, and the severe local storms of the 24th in Missouri and Illinois.

No. I.—This area, central in northwestern Wyoming the morning of the 2nd, moving southeastward, reached western Kansas at midnight. Moving very slowly eastward, with still decreasing pressure, at midnight of the 2nd, it was in northern Missouri. During the 2nd, in the Western Gulf States high temperatures and cloudy weather, with heavy rains, prevailed with brisk to high southerly winds on the Texas coast; maximum velocity, SW. 43 miles at Indianola. In the Upper Missouri and Mississippi valleys, cold northerly winds, with heavy rains, were reported. Destructive local storms, causing loss of life and property, occurred at Ottawa and Girard, Kan., and at Shreveport, La., which are elsewhere mentioned. Changing its course to the northeastward, the storm was central during the 3rd in the region of Lake Michigan. During the 4th it passed slowly northeastward over the Lower Lake region, down the St. Lawrence valley, and by midnight of the 5th it reached the Gulf of St. Lawrence. At midnight of the 2nd a Cautionary Off-shore Signal was ordered at Indianola, and Cautionary Signals for the entire Lake region. The signal at Indianola was lowered the morning of the 4th, justified as to velocity, but not as to direction. The signals in the Lake region were lowered on the morning of the 5th, having been justified on the 4th, in connection with high area No. III., at scattering stations in the Lower Lake region, but at Duluth only in the Upper; maximum velocities: at Duluth, NW. 30; Sandusky, W. 34. The signals displayed in connection with high area No. I., from Fort Macon to Sandy Hook, were continued from the 3rd to the morning of the 5th, when they were lowered, having been fully justified; maximum velocities: Chincoteague, SE. 44; Capes Hatteras and Lookout and Kittyhawk, SW. 36.

No. II.—The approach of this area was marked on the Middle Pacific coast by heavy rains on the 1st, which became general in California by the morning of the 1st, and extended to the Northern Pacific region during that day. The area, on the afternoon of the 2nd, was central, with unusually low pressure, in southern Oregon. The area dividing, one portion moved northeastward, and passed into British Columbia by the morning of the 3rd. In connection with this area and high area No. II., which moved northward along the Pacific coast, unusually heavy rains fell all along the entire Pacific coast from the 1st to the 3rd, over two inches having been reported in that time from many stations. The second portion, moving nearly eastward, passed through Montana and Dakota into Manitoba during the 3rd.

No. III.—This area moved northeastward over the Atlantic Ocean during the 7th, at some distance from and nearly parallel with the coasts of New England and Nova Scotia. This area was possibly a

southern offshoot of No. I. No signals were displayed in connection with this area. Velocities of 27 miles NW. at Eastport and 28 NW. at Boston were reported.

No. IV.—This area was apparently central north of Lake Superior at midnight of the 8th. Moving slowly southeastward, on the morning of the 10th it was central, with greatly decreased pressure, over Lake Huron; Port Huron barometer 0.55 below the normal. Moving thence northeastward over the Lower Lakes and through St. Lawrence valley, it reached the St. Lawrence valley during the 11th, on which day the lowest pressure of the area was reported from Eastport in the afternoon—29.15, or 0.70 below the normal. On the morning of the 9th signals were ordered for the entire Lake region, except Duluth and Lake Ontario. During the afternoon they were ordered for Lake Ontario and the Atlantic coast, from Eastport southward to Chincoteague. These signals were lowered in the Lake region on the morning of the 11th, having been fully justified by unusually high winds during the 9th and 10th; maximum velocities: N. 40 at Escanaba and Grand Haven; NW. 48 at Sandusky; SW. 37 at Buffalo. In connection with advancing high area No. IV the signals in the Upper Lake region were continued during the 10th, and along the Atlantic coast on that date they were changed to Off-shore from Cape Hatteras northward to Eastport. The Cautionary Signals on the Atlantic coast were fully justified; maximum velocities: S. 34 at Boston and S. 40 at Delaware Breakwater.

No. V.—This area appeared on the Northern Pacific coast during the 9th, and, moving northeastward through Washington Territory, passed into British Columbia by the morning of the 10th. Its passage was marked by moderate rains in the Central and Northern Pacific coast regions.

No. VI.—This area—possibly identical with area No. V—was central in Manitoba on the morning of the 12th. Moving southeastward, at midnight it was central in western Minnesota. It remained nearly stationary until midnight of the 13th, when it united with area No. VII in the Lower Missouri valley. On the afternoon of the 12th brisk winds being reported from Lake Michigan and the Lower Lake region Cautionary Signals were ordered for the entire Lake region. These signals—fully justified—are discussed in connection with low area No. VII.

No. VII.—At midnight of the 11th a sharp fall of pressure was reported from the Oregon coast. The area moving southeastward was central the morning of the 13th in Utah; Salt Lake barometer 0.42 below the normal. Moving rapidly eastward, at midnight it united with low area No. VI. in the Lower Missouri valley; North Platte barometer 0.64, Yankton 0.65 below the normal. At that time a cloudless sky within a radius of two hundred and fifty miles from the centre of the depression was reported, and at no point within five hundred miles had precipitation occurred within the preceeding forty-eight hours. Changing its course to the northeast with decreasing pressure, the area was central in the afternoon of the 14th in northwestern Wisconsin; Duluth barometer 29.16 or 0.77 below the normal. Central at midnight of the 14th over the eastern end of Lake Superior, it moved rapidly eastward with increasing pressure and by midnight of the 15th had reached the Gulf of St. Lawrence. The signals displayed in the Lake region for low area No. VI. on the 12th, and continued for this storm, were lowered during the morning and afternoon of the 15th. During the 13th and 14th, brisk to high southerly to westerly winds prevailed in the entire Lake region, fully justifying all signals displayed; maximum velocities: Buffalo, SW. 33; Escanaba, S. 36; Duluth, NE. 38, and Milwaukee, S. 46. Signals for the Texas coast ordered on the 13th, and lowered on the 14th, were justified at Indianola, S. 30; but not at Galveston. On the 13th Cautionary Signals were ordered along the Atlantic coast from Fort Macon northward to Thatcher's Island. The signals north of New York were lowered at midnight of that date, and southward to include Kittyhawk, during the 14th, the signals from Fort Macon to Cape Hatteras remaining displayed until midnight of the 16th, in connection with low area No. VIII. These signals were all fully justified; maximum velocities: Boston and Kittyhawk, SW. 32; Newport, SW. 40; Sandy Hook, SW. 44; Wood's Holl, SW. 53.

No. VIII.—At midnight of the 14th a sharp barometric fall was reported from western Texas, and in the afternoon of the 15th, an area was evidently central in Indian Territory; Dodge City barometer 0.24 below the normal. Moving eastward with rapidly decreasing pressure its centre at midnight was in southern Missouri. During the past 8 hours the barometer had fallen sharply in the central Mississippi valley, where high temperatures, brisk southerly winds and thunder-storms, with heavy rains, prevailed; while from the Lower Missouri valley, cold northerly winds, with rain, were reported. During the evening a severe local storm, seriously damaging property, swept over Natchez, Miss., and its immediate vicinity. On the morning of the 16th the area was central, with diminished pressure, in Illinois; in the afternoon over the western end of Lake Erie, and at midnight in Ontario. At 11 p. m. of the 16th, an abnormal barometric rise of 0.30 in the past eight hours, was reported from the entire Ohio valley, with a marked fall of temperature in the southern half. During that time violent wind-storms occurred throughout the eastern half of Ohio and the western parts of Pennsylvania, and West Virginia: the details of which are given under the heading of *Local Storms*. Central the morning of the 17th in the Province of Quebec, it passed southeastward through New England during the day over the Atlantic Ocean. At midnight of the 15th signals were ordered, except at Duluth, for the entire Upper Lake region, and for Lake Erie, followed on the following morning by signals for Lake Ontario. These signals were lowered on the Upper Lakes at midnight of the 16th and on the Lower Lakes during the 17th. These signals were justified in connection with high area No. VII by gales of unusual severity, accompanied by rain or snow; maximum velocities: Alpena NE. 32; Buffalo, SW. 33; Milwaukee, NE. 36, and Cleveland, W. 50. During the 16th signals were displayed on the Atlantic coast at Eastport, where brisk winds had been reported, and from Sandy Hook south-

ward to Kittyhawk. The signals on the North Carolina coast were lowered at midnight, and those on the New Jersey coast, on the following day. These signals were fully justified; maximum velocities: Sandy Hook, E. 31; Chincoteague, S. 41; Eastport, E. 48.

No. IX.—The pressure fell sharply on the North Pacific coast during the night of the 14th and on the morning of the 15th an area was central on the coast of Washington Territory; Olympia barometer 29.39 or 0.71 below the normal. Moving easterly on the morning of the 16th the area was central in western Montana; Virginia City barometer 0.50 below the normal, and by midnight had passed northeastward into Manitoba. In connection with the passage of this storm, exceedingly heavy rains occurred from the 14th to the 16th on the north half of the Pacific coast, and unusually heavy snow-storms prevailed on the Sierra Nevada mountains. From the 14th to the 16th 4.00 inches of rain-fall at Mendocino, Cal., and during the 15th, 2 feet of snow fell at Truckee and Summit, and 4 feet at Cisco. Several snow slides occurred and travel on the Central Pacific R. R. was seriously interfered with for several days.

No. X.—As area No. IX passed northeastward on the night of the 16th into Manitoba, a considerable fall was reported in the southern segment of that area from Kansas and Nebraska, which continued until morning of the 18th, at which time the area was central in southern Nebraska; Omaha barometer 0.66 below the normal. Moving slowly northeastward, at 3 p. m. of the 18th the area was central in the Missouri valley northwest of Omaha, from which station a S. wind of 42 miles was reported, with the unusually low pressure of 28.85 or 0.90 below the normal and a temperature of 82°. From Bismarck, Dak., and North Platte, Neb., high north winds of 40 and 48 miles, with temperatures below the freezing point, were reported. The report for that afternoon from Yankton has not yet been received. During the preceding eight hours, an abnormal barometric fall, ranging from 0.20 to 0.30, had occurred over the greater part of the States of Iowa and Missouri, and over the eastern parts of Kansas and Nebraska. In the succeeding eight hours an abnormal barometric rise, ranging from 0.30 to 0.34, occurred in the Lower Missouri valley, with an average abnormal barometric fall of 0.16 in the Upper Missouri valley. From 3 p. m. to 11 p. m. of that date the temperature fell 52° at Omaha and 35° at Leavenworth, while in the Upper Mississippi valley the temperature remained stationary at La Crosse; rose 1° at St. Paul, and fell but 1° at Davenport. At 11 p. m. the area was central in the Upper Mississippi valley; St. Paul barometer 28.89 or 0.97 below the normal. Thunder-storms, with high temperatures and brisk southerly winds, then prevailed in the Upper Mississippi valley, while cold north to west winds, ranging from fresh to high, were reported from the Missouri valley. During the evening of that day occurred violent tornadoes in Arkansas, Missouri, Iowa and Illinois. These violent storms by which nearly one hundred persons were killed, and several hundred wounded, and during the passage of which immense damage was done to property throughout these States are as fully described, as is possible at this date, under the head of *Local Storms*. The area, central the morning of the 19th over the western end of Lake Superior—Duluth barometer 28.77 or 1.07 below the normal—passed northeastward during the day into British Columbia. Its course over the Lake region was marked by unusually high winds in the Lake region, where the signals displayed during the 18th, and lowered on the 19th, were fully justified; maximum velocities: Escanaba, S. 33; Toledo and Grand Haven, SW. 40; Alpena and Port Huron, SW. 44; Milwaukee, SW. 48; and Sandusky, NW. 52. Cautionary Signals were displayed during the 18th and 19th from Wood's Holl southward to Fort Macon, and were generally lowered the morning of the 20th. These signals were generally justified: maximum velocities: Barnegat, NE. 28; Wood's Holl, S. 38; Delaware Breakwater, S. 43.

No. XI.—This area, of but slight energy and minor importance, developed during the 19th in Mississippi. Its course was generally easterly and it passed off the Carolina coast during the night of the 20th. No signals were displayed during its passage.

No. XII.—This area, appearing in Dakota on the morning of the 21st, moved eastward during the day through Minnesota and the Upper Lake region, and during the 22nd passed northeastward over Canada to the north of St. Lawrence valley. No signals were ordered for the Lake region in connection with this area. Brisk winds were reported from the Upper Lake region during the 21st, with a maximum velocity of 36 miles SW. at Milwaukee. On the morning of the 22nd, Cautionary Signals were displayed on the New Jersey and Virginia coasts, which were lowered the next morning, having been fully justified; maximum velocities: SW. 27 miles at Chincoteague, and SE. 38 at Delaware Breakwater.

No. XIII.—This area appeared on the Northern Pacific coast during the night of the 19th, and moving eastward through Oregon and Idaho was central in western Montana on the morning of the 22nd. Its passage through the Pacific Coast region was marked by exceedingly heavy rains during the 20th and 21st in the northern half of California; rainfalls, ranging during that time from 3.00 inches to 9.73, being reported. The valleys in the central and northern portions of the State suffered severely from inundations, which damaged crops, washed out railways, carried away bridges, etc. Heavy and violent snowstorms generally prevailed in the Sierra Nevadas, which caused frequent snow-slides and interrupted travel for several days on the C. P. R. R. Pursuing a southeasterly course from Montana, it was central the afternoon of the 23rd in eastern Nebraska; Omaha barometer 29.10, or 0.65 below the normal. The storm remained central with gradually increasing pressure in the valley of the Lower Missouri until midnight of the 24th, when it was in central Missouri. During the 23rd remarkable differences of temperature prevailed between the northwestern and southeastern sides of the area, the difference amounting in some cases to over 30° in a distance of 200 miles. These remarkable differences of temperature continued until the morning of the 25th. About 7 p. m. of the 23rd a severe cyclone occurred in Adams county, Illinois, doing much damage in Lor

raine, Lima and Keene, and injuring many persons. At 5 p. m. of the 24th a severe tornado occurred in Jasper county, Missouri, and at 7 p. m. in Christian county, Illinois, killing and injuring persons and doing great damage to property. Violent thunder-storms also occurred at various other points in Illinois and Missouri. Details are to be found under the head of *Local Storms*. The area moving due northward during the night was central the morning of the 25th in Iowa and that afternoon in Wisconsin. Changing its course to the northeast it passed over the Upper Lake region during that night, and on the 26th moved down the valley of the St. Lawrence. The signals displayed in the Lake region on the 22nd for high area No. X, were continued for this storm until the afternoon of the 25th, and were then lowered, having been fully justified, as shown elsewhere.

No. XV.—This area advanced southeastward from Saskatchewan during the 27th, reaching Dakota the morning of the 28th. Thence, by a nearly northeast course, it passed during the 29th through the Upper Lake region, and on the 30th down the valley of the St. Lawrence. Its passage through the Lake region was marked by brisk winds, which justified, except at scattered stations, the signals displayed during 29th and part of the 30th; maximum velocities: Grand Haven, E. 28; Rochester, W. 32; Milwaukee, NW. 36; and Sandusky, NW. 42. On the Atlantic coast Cautionary Signals were displayed during the 29th at all stations except Jacksonville. These signals were lowered during the 30th on the South Atlantic coast, but were continued on the New England and Middle Atlantic coasts until the morning of May 1st. During the 29th violent southerly gales, with heavy rain-squalls, prevailed along the entire Atlantic coast, followed, in connection with advancing nigh area No. IX, by heavy westerly gales from Maine to Delaware; maximum velocities: Boston, SW. 37; Eastport, S. 39; Barnegat, S. 43; Kittyhawk, S. 46; Delaware Breakwater, S. 52; Wood's Holl, S. 56. This storm was generally reported to have been one of the severest experienced for years along the New England and Middle Atlantic coasts.

INTERNATIONAL METEOROLOGY.

Two International Charts, Nos. IV and VI, accompany the present REVIEW. They are for the months of *September*, 1877, and *March*, 1878. The charts of mean pressure, &c., for *September*, 1878, have been delayed to permit the compilation of chart for *September*, 1877, which completes the series for the autumn months of that year.

No. IV indicates the probable course of six of the principal storm-areas (No. I, II, IV, VI, IX and XI) occurring over the North Atlantic ocean during the month of *March*, 1880. This month was generally characterized by a rapid succession of high and low pressure areas and consequent stormy weather over the United States, Canada and that portion of the North Atlantic ocean to the north of a line running from the Bermudas to 50° N. 25° W., while over northwestern Europe high pressures and, in general, clear, dry weather were prevalent, except during the regime of low areas Nos. I, III and XI. Area No. I was, on the 1st, 2nd and 3rd, central to the north of the British Isles and North Sea, whilst the trough of low pressure extended far to the westward over the Atlantic; severe westerly gales prevailed from the English channel to 40° W., and from this meridian to the American coast, cold northwesterly winds, accompanied by occasional violent snow and hail-squalls, in advance of an area of high pressure (No. I, March WEATHER REVIEW) central over the United States. On the 3rd the highest pressure of the month (about 30.47 in., or 774.0mm.) was recorded at the Bermudas, and from the 4th to the 7th this high pressure moved slowly eastward to the region of the Azores. During these days, namely, from the 4th to the 7th, two areas of low pressure (the last of which is shown on chart No. IV as area No. II) left the American coast and, passing eastward over the Banks of Newfoundland, curved towards the northeast, about 50° W.; hard to violent winds, from S. to W., accompanied by severe rain-squalls, were experienced from 40° to 50° N. and from 30° to 50° W. During the 7th the pressure rose rapidly over western Europe, and on the morning of the 8th an area of quite high pressure covered the region included between 15° W. and 25° E. and 35° to 60° N. From the latter date to the 29th the pressure remained high over the greater part of this region, and apparently formed a barrier to the passage eastward of low pressure areas from the Atlantic. On the 9th only moderate winds were reported over the Atlantic, except that S. S. *Amerika*, in 48° 29′ N., 31° 10′ W., had an ENE. wind, force 8, with barometer down to 29.52, or 749.8. This appears to have been due to a small area which passed northward on the 10th, followed by NW. gales about 50° N. 30° W. Area No. IV. (No. V, March REVIEW) passed off the American coast during the morning of the 9th, and on the 10th passed eastward to the north of the Bermudas, where the wind increased to WSW., force 6, with threatening weather. Brigantine *George*, (10th,) in 32° 25′ N., 68° 35′ W., had a WSW. moderate gale, with low barometer, showers and rough sea. High pressures (area No. IV, March REVIEW) and cold weather prevailed in the vicinity of Newfoundland. On the 11th and 12th low area No. IV moved rapidly northeastward; and severe gales from SE. to NW. have been reported in 41° N. 60° W., 42° N. 53° W., 43° N. 47° W., 47° N. 40° W., and continued southerly gales thence eastward. S. S. *Amerika* (11th, in 45° N. 43° W.) reported barometer, at 7:35 a. m., Washington time, 29.30, or 744.2, wind SW., force 11, very heavy sea; "had a heavy gale from SE. to NNW. and back to W." Bark *Silver Cloud*, from New Brunswick to Great Britain, on the 11th had a severe SE. gale, with terrific squalls, veering, at 5 p. m., to SSE., and on the 12th severe gale from NNW.—vessel abandoned on the 12th in 45° N. 42° W. After the morning of the 12th, the progressive motion of this area appears to have lessened decidedly, and the area to have curved toward the east. S. S. *Hibernian* reports 12th, in about 50° 39′ N. 33° 17′ W., lowest barometer 29.25, or 743.0, strong gale from SE. by S., with heavy rain; 13th, 52° 17′ N. 27° 14′ W., lowest barometer 29.26

or 743.2, wind SE. by E., violent gale of hurricane force, and heavy rain of short duration. On the 14th S. S. *Ohio* reports, in 49° 49′ N. 26° 55′ W., barometer 29.35 or 745.5, wind WSW. 6, with hail. From the 15th to the 18th, low pressure, with hard gales and high seas, continued to prevail over the eastern portion of the Atlantic (between 45° and 55° N.), and from the 16th to the 19th a low pressure area (No. X, March REVIEW) moved rapidly northeastward from the American coast, crossing the Banks of Newfoundland on the 17th, to about 55° N. 30° W. on the 19th. On the 19th and 20th, low area No. VI (No. XI of the March REVIEW) passed rapidly eastward as a severe hurricane, from the American coast, between Nova Scotia and the Bermudas, to about 50° W. S. S. *Celtic*, 20th, in 40° N. 63° W., 7.35 a. m., Washington time, reports barometer 28.53 or 724.6, wind N. by W., force 12, and also adds "from 10 a. m. until 4 p. m. terrific gale from N., with hurricane force at times, compelled to steer ship before the sea to avoid damage, the wind having veered from E. to N., with a tremendously high confused sea." S. S. *Ohio* reports 19th, 43° N. 54° W., barometer 30.14, NW. 3, snow; 20th 42° N. 58° W., barometer 28.82., NW. 11, thick snow storm; and 21st, 40° N. 66° W., 29.84, SE. 2, snow; and adds "from midnight (19th and 20th) to 4 p. m., 20th, violent gale, commencing at ESE. and backing to N., with very heavy squalls and thick snow, barometer falling rapidly—kept ship before the sea until 7 p. m." As instances of the unsettled condition of the weather prevalent over this portion of the Atlantic during the latter half of March the following may be noted: the *Ohio* reported snow or hail on each day from the 14th, in 50° N. 27° W., to the 21st, in 40° N. 66° W., the barometer observations showing low pressures on the 14th, 16th, 18th and 20th; the *Nederland*, from the 17th, in 48° N. 19° W., to the 29th, in 40° N. 73° W., reported "much rain" for the 24 hours preceding the reports of the 17th, 19th, 21st, 22nd, 23rd and 28th, "rain" on 25th, "showers" on 20th and "snow" on the 24th, 27th and 29th, had low pressures on the 17th, 19th, 22nd, 25th and 28th. During the hurricane of the 19th, 20th and 21st many disasters to shipping occurred, among which the following may be noted: Brig *Rescue* abandoned in 39° N. 70° W.; Brig *Victor* abandoned in 37° N. 58° W.; Bark *Memphis* abandoned in 39° N. 59° W.; Ship *Wassenaar* abandoned in 44° N. 39° W.; Bark *May Queen* lost two men overboard; Bark *Queen of Hearts* in 38° N. 62° W. lost three men overboard; while numerous vessels had decks swept of everything movable. From the 22nd to the 26th this storm moved very slowly northeastwards with diminished energy near the center, but followed by northwest gales, high seas, rain, sleet or snow from 35° to 55° W. Low area No. IX (No. XIV March REVIEW) passed off the New England coast on the 24th, and moved east and northeastward off the coasts of Nova Scotia and Newfoundland during the 25th and 26th, accompanied by very low pressures and followed by northwesterly gales and high seas. On the morning of the 28th, while low area No. XV was yet central over the United States, a second centre had formed off the Middle Atlantic coast, which rapidly developed into a severe storm (see No. XI present REVIEW). During the 28th, 29th and 30th it moved rapidly east and northeastward, and was encountered by the following vessels: Schr. *Addie Fuller* on the 26th, in 32° N. 80° W., 28th, in 35° N. 75° W. and 30th in 35° N. 73° W, reports: "26th, at sunset, weather threatening; midnight, gale commenced with S. wind, which lasted until morning of the 28th; it veered gradually to WSW; had occasionally terrific squalls during the gale, with velocities of 40 or 50 miles; 27th, midnight, the barometer was at its lowest (29.50 as read off); 28th, fine weather and nearly calm all day, barometer continuing low; at 8 p. m. gale commenced with wind from NNW., increasing in force from 20 to 50 miles, and continued until morning of the 31st, with severe squalls of hail and rain." S. S. *Scythia* reports: "28th, 43° N .55° W., barometer 29.70 or 754.4, wind S., heavy rain; 29th, 42° N. 59° W., 29.33 or 745.0, NW. by W., force 4, cloudy, rough sea; and adds "Sunday, March 28th, from 3 p. m. to Monday, 29th, 4 a. m., storm with wind veering from SW. to W'ly and N'ly, with very high sea, barometer 29.28." S.S. *Hibernian*, 29th, in 53° N. 26° W., and 30th, in 52° N. 31° W.—"29th, heavy gale from S., with torrents of rain and heavy sea; 30th, strong gale from WSW., with heavy sea, lowest barometer 29.22 or 742.2." On the 30th the barometer fell rapidly over northwestern Europe, thereby ending the period of high pressures which had continued since the 8th over this region. During the 31st the low area No. XI passed eastward over the British Isles and ushered in a period of unsettled weather, which continued over these Isles until the 6th of April. By afternoon of the 28th low area No. XV of the March REVIEW, referred to above, had passed off the American coast; during the 29th and 30th it moved slowly eastward between the Bermudas and Nova Scotia, and on the 31st was central some distance south of Newfoundland. The lowest pressures of the month, accompanied by thunder, lightning, rain and moderate gale, were experienced at the Bermudas on the 29th and 30th.

TEMPERATURE OF THE AIR.

The mean temperatures for April, 1880, are shown on chart No. II. The table of average temperatures on that chart shows that the temperature was above the normal from Texas and the Mississippi valley eastward to the Atlantic, except in the lower St. Lawrence valley, and the Canadian Maritime Provinces. Over the entire country westward of Texas and the Mississippi valley deficiencies were reported, except from the Middle Rocky Mountain Slope. The greatest excess of temperature prevailed in the Middle, South Atlantic, Gulf States, Tennessee and the Ohio valley, ranging from 3.°0 to 4.°0 above the normal. The deficiency of 3°.2 reported from the Missouri valley, covers the entire valley; if divided an excess of 2.°7 would have been credited to the Lower valley, and a deficiency of about 9.°0 to the Upper valley. On the Pacific coast the greatest deficiency is reported from the central region, 3.°0.

Maximum and Minimum Temperatures.—Maine: *Cornish, 70°; Portland, 65°; Eastport, 17°; *Orono, 14°. *New Hampshire:* *Contocookville, 76°; Mt. Washington, 40°; *Dunbarton, 18°; Mt. Washington, —12°. *Vermont:* *Windsor, 74°; Burlington, 69°; Burlington, 16°; *Lunenburg and *Newport. 14°. *Mass-*

achusetts: *Springfield Armory, 79°; Springfield, 77°; Thatcher's Island, 20°; *South Lee and *Somerset, 18°. *Rhode Island:* *Fort Adams, 64° and 24°; Newport, 63° and 26°. *Connecticut:* *Southington, 78°; New Haven, 75; New London, 24°; *Southington, 19°. *New York:* *Ardenia, 81°; New York City, 76°; Rochester and Buffalo, 20°; *Schroon Lake and *Plattsburg Barracks, 16°. *New Jersey:* *Dodge Mines, 87°; Barnegat, 79°; Atlantic City, 24°; *New Lisbon and *Vineland, 22°. *Pennsylvania:* Pittsburgh, 84°; Erie, 26°; *Franklin, 15°. *Delaware:* Delaware Breakwater, 79° and 32°; *Dover, 32°. *Maryland:* *Sandy Springs, 85°; Baltimore, 80° and 30°; *Woodstock, 23°. *District of Columbia:* Washington, 82° and 28°. *Virginia:* *Accotink, 90°, Norfolk, 84° and 27°; *Wytheville, 23°. *West Virginia:* *Helvetia, 82° and 15°; Morgantown, 81° and 28°. *North Carolina:* Wilmington and *Weldon, 90°; Charlotte and Kittyhawk, 33°; *Sulphur Springs, 25° *South Carolina:* Charleston, 85° and 33°. *Georgia:* *Gainesville, 92°, Augusta and Savannah, 88°; Atlanta and Augusta, 36°; *McPherson Barracks, 29°. *Florida:* *Houston, 96°, Jacksonville, 91° and 42°; *St. Augustine, 41° *Alabama:* Montgomery, 90° and 40°. *Louisiana:* *Okalooska, 94° and 35°, Shreveport, 93° and 40°. *Arkansas:* *Mount Ida, 95° and 32,° Little Rock, 94° and 43°. *Texas:* Eagle Pass and Rio Grande City, 105°; Fort Elliott, 26°, *Fort Concho, 25°. *Tennessee:* *Ashwood, 89°, Chattanooga, 88°; Knoxville and *Ashwood, 30°. *Kentucky:* Louisville, 87° and 31°; *Bowling Green, 30°. *Ohio:* *Cincinnati, 87°, Cincinnati, 83°; Cleveland, 27°; *Wooster and *Westerville, 22°. *Indiana:* *Laconia, 87°. Indianapolis, 83° and 27°; *Vevay, 24°. *Illinois:* *Mount Sterling, 86°, Cairo, 83°; Chicago, 27°, *Riley, 20°. *Michigan:* *Hudson, 80°, Port Huron, 73°; Alpena, 14°, *Fort Brady, 4°. *Wisconsin:* *Beloit, 80, Madison, 78° and 23°; *Neillsville, 18°. *Missouri:* *Corning, 94°, St. Louis, 86° and 30°; *Pierce City, 26°. *Iowa:* *Glenwood, 92°, Des Moines, 84°; Dubuque and Des Moines, 26°; *Logan, 15°. *Minnesota:* Breckenridge, 80° and 13°. *Indian Territory:* Fort Sill, 96°; Fort Gibson, 34°. *Kansas:* *Holton and *Cedar Vale, 94°; Dodge City, 92° and 24°. *Nebraska:* *Howard, 97°, North Platte, 90° and 20°; *Camp Sheridan, 15°. *Dakota:* *Fort Hale, 90° Yankton, 82°; Pembina, —3°. *New Mexico:* Socorro, 80°; Santa Fé, 17°, *Fort Union, 14°. *Colorado:* Denver, 77° and 20°; *Fort Garand, 10°, Pike's Peak, 32° and —9°. *Wyoming:* *Fort Fetterman, 77°, Cheyenne, 73° and 15°; *Fort Fred Steele, 10°. *Montana:* Fort Benton, 81°, Fort Assiniboine, —20. *Idaho:* Boise City, 79° and 30°; *Fort Hall, 10°. *Utah:* Salt Lake City, 75° and 27°, *Camp Douglass, 75° and 23°. *Nevada:* *Fort McDermit, 80°, Winnemucca, 74° and 22°. *California:* *Fort Yuma, 96°, Red Bluff, 88°; Campo, 24°. *Oregon:* Umatilla, 89° and 29°; Roseburg, 29°. *Arizona:* Yuma, 94°; Fort Apache, 20°. *Washington Territory:* Olympia, 82° and 28°.

Those marked with a star (*) are reported by U. S. Army Post Surgeons or Voluntary Observers.

Ranges of Temperatures at Signal Service Stations.—The *monthly ranges* will appear from the maxima and minima just given. The greatest *daily ranges* vary in New England from 19° at Wood's Holl to 35° at at Boston; Middle Atlantic States, 19° at Cape May to 41° at Albany; South Atlantic States, 17° at Cape Lookout to 34° at Augusta and Wilmington; Eastern Gulf States, 13° at Key West and 24° at Pensacola to 32° at Montgomery; Western Gulf States, 21° at Galveston to 35° at Corsicana; Tennessee and Ohio valley, 24° at Cairo to 48° at Pittsburgh; Lower Lake region, 29° at Oswego to 41° at Cleveland; Upper Lake region, 24° at Grand Haven to 39° at Milwaukee; Upper Mississippi valley, 30° at La Crosse to 43° at Des Moines; Red River of the North valley, 42° at Pembina and 50° at Breckenridge, Missouri valley, 30° at Leavenworth to 51° at Fort Buford, and 53° at Omaha; Rio Grande valley, 31° at Rio Grande city to 45° at Eagle Pass; Eastern Rocky Mountain Slope, 33° at Virginia City to 53° at North Platte, and 54° at Fort Elliott; Plateau Districts, 33° at Boise City and Salt Lake City, 42° at Santa Fe; Pacific slope, 19° at San Francisco to 36° at Red Bluff.

Frosts.—Freezing temperatures were occasionally reported from Signal Service Stations as follows: Northern Pacific coast region, till 8th; Plateau districts, except southern Arizona, till 29th; along central and northern Rocky Mountain slope, and, north of 42nd parallel, eastward to the Atlantic Ocean, throughout month; east of Mississippi valley and north of 33rd parallel, till 12th; northern Ohio and Pennsylvania, till 30th. The following cases of interest are noted: *Alabama:* Heavy frost, 11th to 14th, killing vegetables, injuring fruit, corn, wheat and cotton at Troy, Greensboro, Blountsville, Wetumpka and other places. *Delaware:* 11th, general and severe throughout peninsula, seriously damaging peach blossoms. *Georgia:* 9th to 12th, severe, killing fruit and vegetables and damaging much cotton in northern half of State. *Kentucky and Tennessee:* 9th to 12th, severe, killing fruit and vegetables and injuring wheat. *Louisiana:* Okalooska, 9th. *Mississippi:* Vicksburg and Fayette, 9th and 10th. *Ohio:* 30th, damaging gardens and fruit somewhat. *Texas:* 8th and 9th, general in interior of State as far south as Castroville and Uvalde. *Arizona:* Burkes, 19th. *California* near Mt. St. Helena, 18th destroying peach crop first time in 16 years.

Ice was general north of parallel 40°. The following cases are noted as of interest: *Georgia:* Forsyth, 13th; Augusta, 10th, thin, in country near. *North Carolina:* Weldon and Wilmington, 12th; Charlotte, Statesville and Lenoir, 12th and 13th. *Indiana:* Logansport, 30th. *Tennessee:* Ashwood, 9th. *Virginia:* Walnut Grove, Johnsontown and Mt. Solon, 12th. *New Jersey:* Newark, 30th. *Kansas:* Holton, 27th.

PRECIPITATION.

The general distribution of the rain-fall, including melted snow, for April, 1880, is illustrated upon chart No. III, as accurately as possible from about 500 reports. On the chart is given average precipitation for April. As will appear from that table, slight deficiencies are reported from Minnesota, the Eastern Gulf and Middle Atlantic States, and a slight excess from the Western Gulf States. Deficiencies of from one

to two inches are reported from New England, Tennessee, the South Atlantic States, Florida and the Missouri valley. An excess of one and a half inch is reported from the Lake region and the Ohio valley, and of two and a half inches from the St. Lawrence valley. On the Pacific coast the rainfall has been excessive in California, particularly in the central valleys. Over the Middle Pacific Coast region the precipitation was five times the amount of the April mean, being 7.86 above the normal.

Specially Heavy Rains.—1st, New Ulm, Tex., 1.12 in 4 hours, 15 min.; Brackettsville, Tex., 1.61 in 2 hours, 20 min. 1st and 2nd, Auburn, Cal., 2.10; Shasta, Cal., 2.70. 2nd and 3rd, San Buenventura, Cal., 1.95 in 36 hours; Highlands, N. C., 3.00 in 29 hours. 3rd, Chattanooga, Tenn., 3.09 in 16 hours; Point Pleasant, La., 2.00 in 5 hours; Decatur, Ala., 2.00. 3rd and 4th, Gainesville, Ga., 2.30; Ellsworth, N. C., 2.50 in 25 hours; Thatcher's Island, 2.66 in 13 hours. 4th, Wellsboro, Pa., 1.35 in 2 hours. 40 min. 7th, Corsicana, 2.79 of which 2.35 in 8 hours. 7th and 8th, Vicksburg, 3.09 in 24 hours; Point Pleasant, La., 3.01. 14th to 16th, Mendicino, Cal., 4.00; Point Arenas, Cal., 3.00. 15th and 16th, Evansville, Ind., 3.30; 16th, Ft. Barrancas, Fla., 2.24 in 4 hours. 15th, San Francisco, Cal., 1.33; Louisville, Ky., 2.28 of which 1.84 fell in 2 hours and 45 min. 14th and 15th, New Harmony, Ind., 2.40; Point Pleasant, La., 4.01 in 8 hours; Fayette, Miss., 15th and 16th, 9.00 in 8 hours. 16th, Louisville, Ky., 1.78 in 6 hours; Vevay, Ind., 1.25 in 4 hours; Bowling Green, Ky., 2.04; St. Meinard, Ind., 1.95 in 6 hours; Pensacola, Fla., 2.30 in 8 hours; Mt. Auburn, Ohio, 1.63 in 2 hours; Wellsboro, Pa., 1.10 in 1 hour and 50 min. 18th, Madison, Wis., 2.15 in 6 hours. 19th, Memphis, 1.79 in 2 hours; Ft. Smith, Ark., 2.18; Little Rock, 1.23 in 4 hours; Princeton, Cal., 19th and 20th, 3.63; Red Bluff, 19th to 21st, 4 47. 20th, Kittyhawk, N. C., 2.15 in 3 hours; Corsicana, 1.30 in 3 hours; 19th and 20th, Green Spring, Ala., 3.82 in 9 hours; New Orleans, 3.18 in 24 hours. 20th and 21st, San Francisco, 3.20; Mt. St. Helena, Cal., 14.70; Sacramento, Cal., 8.37, of which 6.35 in 16 hours; Healdsburg, Cal., 9.73 in 48 hours; Santa Rosa, Cal., 6.70 in 48 hours; San Luis Obispo, Cal., 3.00 in 36 hours; Grass Valley, Cal., 4.50 in 18 hours; Georgetown, Cal., 4.00 in 24 hours; Nevada City, Cal., 5.20 in 24 hours, and "April to date, 22.98 inches, being six times the average for April"; Forest City, Cal., 6.54 in 48 hours; Modesto, 7.00 in 48 hours; Tomales, Cal., 5.02 in 40 hours. 23rd, Georgetwn, Cal., "April to date 25.50 inches." 23rd, North Lewisburg, Ohio, 3.10 in 3½ hours; New Corydon, Ind., 3.79 in 11 hours. 23rd and 24th, Norwalk, Ohio, 2.51; Bellefontaine, Ohio, 3.50; Augusta, Ga., 1.00 in 1 hour; Newton, Ia., over 4.00 inches. 24th, Keokuk, 2.45 in 8½ hours; Vevay, Ind., 1.10 in 1 hour; Pierce City, Mo., 1.00 in 1 hour. 24th to 26th, Wellsboro, Pa., 4.82. 24th and 25th, Indianapolis, 3.03, of which 1.17 fell in 5 hours; Bethel, Ohio, 2.75. 25th, Vevay, Ind., 2.20 in 12 hours; Ringgold, Ohio, 0.80 in 12 min. 26th Point Pleasant, La., 2.01 in 10 hours; 25th and 26th, Mt. Auburn, Ohio, 2.07. 28th, Shreveport, 2.05 in 8 hours; Brackettsville, Tex., 2.05 in 6 hours; San Antonio, Tex., 2.79 in 1½ hours; Castroville, Tex., 1.73 in 3½ hours; Mesquite, Tex., 2.00; Mt. Ida, Ark., 28th and 29th, 2.05 in 25 hours; Highlands, N. C., 28th and 29th, 2.60 in 15 hours; Charlotte, N. C., 2.19; Washington, D. C., 2.05. 29th, Lynchburg, 2.20; Ellsworth, N. C., 3.50 in 12 hours; Point Pleasant, La., 2.00 in 2 hours.

Largest Monthly Rain-falls, including melted snow.—Georgetown, Cal., 25.50 in.; Shasta and Healdsburg, Cal., over 18.00 in.; Sacramento, Cal., 14.20 in.; Fayette, Miss., 13.40 in.; Cincinnati, (College Hill) 10.50 in.; Chattanooga, Tenn., 10.37 in.; Green Springs, Ala., 10 15 in.; Murphy, N. C., 9.30 in.; New Corydon, Ind., 9.08 in.; Kalamazoo, Mich., 8.00 in.

Smallest Monthly Rain-falls, including melted snow. – Fort Yuma, Cal., 0.00; Yuma, Ariz., and Fort Union, N. M., trace; Brownsville, Tex., 0.01 in.; Tucson and Camp Grant, Ariz., 0.04 in.; Socorro and Santa Fè, N. M., 0.05 in.; El Paso, Tex., 0.10 in.; Dodge City, Dak., 0,11 in.; Fort Davis, Tex., 0.14 in.; Phoenix and Burkes, Ariz., 0.15 in.; North Platte and Fort Elliott, Tex., 0.16 in.; Cheyenne, W. T. 0.17 in.; Edinburg, Tex., 0.19 in.; Wickenburg, Ariz., 0.25 in.; Camp Verde, Ariz., 0.27 in.; Olivet, Dak., and Denver, Col., 0.31 in.; Key West, Fla., 0.33 in.; Vail, Io., 0.32 in.; Yankton, Dak., 0.40 in.

Rainy Days.—The number of days on which rain or snow has fallen, varies as follows: New England, 2 to 23; Middle Atlantic States, 8 to 20; South Atlantic States, 9 to 15; Eastern Gulf States, 4 to 13; Western Gulf States, 8 to 13; Lower Lake region, 17 to 21; Upper Lake region, 12 to 20; Ohio valley and Tennessee, 10 to 17; Upper Mississippi valley, 7 to 12; Missouri valley, 4 to 9; Red River of the North valley, 5 to 12; Eastern Rocky Mountain Slope, 1 to 10; Texas, 0 to 9; Rocky Mountains, 2 to 11; Middle Plateau, 1 to 14; California, 16 to 18; Oregon, 15 to 18.

Cloudy Days.—The number varies in New England from 6 to 16; Middle Atlantic States, 4 to 11; South Atlantic States, 4 to 13; Eastern Gulf States, 0 to 16; Western Gulf States, 5 to 16; Lower Lake region, 10 to 16; Upper Lake region, 8 to 15; Ohio valley and Tennessee, 5 to 13; Upper Mississippi valley, 4 to 10; Missouri valley, 4 to 10; Red River of the North valley, 10; Eastern Rocky Mountain Slope, 3 to 9; Texas, 4 to 14; Rocky Mountains, 3 to 11; Middle Plateau, 0 to 15; California 9 to 13.

Droughts prevailed in central and westen Kansas and in the interior of Texas, until ended by the heavy rains of the 27th to 30th.

Floods.—The following notes have been gathered regarding damage in Lower Mississippi valley from high water during latter part of March and during April. *March 23rd*: Much land overflowed in Crittenden Co., Ark. Many cattle drowned or starved. Many houses uninhabitable. Along White river much land overflowed as far up as St. Charles; a large amount of stock drowned. Levee at O. K. landing broke March 27th; crevasse 40 feet wide. The Sharp crevasse, 4 miles above Gretna, La., occurred *April* 1st; enlarged by 2nd to 70 feet wide with central depth of 15 feet. On 2nd 5,000 acres under water. Two culverts on Morgan railway, 8 miles from Algiers, washed out, interrupting travel. Main crevasse closed on 7th,

but slight breaks occurred on 9th and frequently to 30th. 10th, Water from Morganzia crevasse, in West Baton Rouge Parish, La., slowly encroaching on rear lands. Northern Texas railway continues inundated; between Vicksburg and Munroe 40 miles is traversed by skiffs, rest by rail; regular through trains not expected before May 1st. 16th, Crevasse on left bank of Bayou La Fourche, one mile below Thibodeau, La. Night 16th and 17th, levee broke on Tensas river near Stanton's plantation, submerging entire Black and Tensas river country. 17th. Frogmore, Concordia Parish, La.: "water has commenced falling; levees on Cross Bayou, above and below here have given away at several places. Moro and Dunbarton levees on Tensas river have given way, flooding the country for miles." Mineola, Texas, 1st, during previous night very heavy rain and remarkable rise in Sabine river; washouts on railway between Mineola and Tyler. 3rd. Toccoa Falls, Ga., heaviest rain for years; about 12 miles air-line railway track washed out and bridge over Tugalo river carried away. 18th. Freshet in Bogue Chilto, submerging 6 miles track of Jackson railway and interrupting travel between Brookhaven and Coon City, Miss. 25th. Farmers City, Ill., creeks higher than ever before known. Princeton, Cal., 22nd, Sacramento river, 23 ft. 1 in. above zero, highest water ever known. 23rd, much damage in Sacramento, San Joaquin, Santa Clara, Napa, and other valleys in central and western California, from very heavy rains, 20th–23rd. 21st, Yolo levee, near Sacramento, broke. Peoria, Ill., 24th, city flooded, many buildings damaged; numerous washouts and land-slides, interrupting railway travel. Litchfield, Mich., 30th, St. Joseph river highest for 25 years. Fayette, Miss., 16th, streams highest ever seen; crops, bridges and stock swept away, damage very great.

Hail.—Hail-storms have been especially frequent and cannot be enumerated in detail. The following storms were unusually severe or interesting from the size of the hail-stones. *March* 31st, very violent in parts of Cowen and Dallas counties, Texas; near Plano the hail zone was 200 yards wide; the stones were as large as hickory nuts, and covered the ground like snow-drifts. *April* 1st, Ft. Eweli, Tex., violent, stones pierced tents and knocked shingles from roofs. 4th, Knoxville, Tenn., very severe, stones as large as partridge's eggs fell in great quantities. 6th, Spartansburg, S. C., "terrific, the severest since memorable storm of June, 1840. Some stones 6 inches in circumference. Much damage to glass, and to fruit trees." Denny's Cross Roads, S. C., "worst ever known in this section; lasting 20 minutes; stones from size of partridge to hen's eggs." 7th, Maxey's, Ga., several stones 12 inches in circumference; hail fell for 15 minutes, much like snow, a calm prevailing. Bairdstown, Ga., one stone weighed 2 pounds. 16th, Merced, Cal., heaviest for years. 17th, Fayetteville, Tenn., stones size of hen's eggs, weighing 4 to 6 ounces. 18th, Mentor, Ohio, stones as large as marbles. 22nd, Tama, Iowa, stones as large as english walnuts. 26th, Oakville, Ont., violent. Montgomery, N. Y., 6th, violent, doing much damage to buildings. 29th, Columbia, S. C., stones as large as hen's eggs. Gainesville, Ga., 4th, stones one inch in diameter; 6th, "size of chestnuts." Nora Springs, Iowa, 24th, of one to two inches in diameter, "soft, snowy texture." Fort Madison, Ia, 24th, size of quail's eggs. Point Pleasant, La., half-inch in diameter. Hudson, Mich., 3rd, "very severe, stones large as walnuts. Twenty-four picked up half-hour after falling weighed 72 oz. Fowls killed and farm houses damaged." Pierce City, Mo., 24th, stones 1.5 by 1.2 in. in diameter. Newark, N. J., 5th, ½ to ¾ in. in diameter. Franklin, Pa., 4th, large, breaking much glass. Wytheville, Va., 25th, average diameter, ½ in., of some ¼ inch. Red Bluff, 20th, ⅜ in. in diameter, covering ground. Fort Sill, 17th, ½ in. in diameter. Castroville, Tex., 28th and Mason, Tex., 6th, "size of hen's eggs." Near Mt. Airy, Ga., 3rd, "reported as large as a man's fist." Savannah, Ga., 4th, some 1¼ in. in diameter; much glass broken in city; gardens seriously damaged. Augusta, 6th, size of partridge eggs, covered the ground; "this hail-storm is reported to have killed young stock in Orangeburg, Co., S. C."

RELATIVE HUMIDITY.

The percentages of mean relative humidity for the month range as follows: New England, frem 57.6 to 85.5; Middle Atlantic States, 47.2 to 84.1; South Atlantic States, 60.4 to 79.2; Eastern Gulf States, 67.6 to 77.6; Western Gulf States, 59.3 to 79.5; Ohio valley and Tennessee, 53.6 to 70.0; Lower Lake region, 61.9 to 66.6; Upper Lake region, 62.9 to 72.6; Upper Mississippi valley, 53.7 to 62.0; Missouri valley, 45.9 to 68.4; Red River of the North valley, 72.8 to 75.0; Eastern Rocky Mountain Slope, 23.0 to 72; Western Plateau, 19.0 to 54.8; California, 67.5 to 78.9 Oregon, 52.0 to 70. *High stations* report the following averages not corrected for altitude: Pike's Peak, 68.9; Mt. Washington, 85.0 per cent.

WINDS.

Total Movements of the Air.—The following are among the *largest* total movements in various sections of the country: Pike's Peak, 16,279; Portsmouth, N. C., 13,560; Delaware Breakwater, 13,958 miles; Wood's Holl, 12,491; North Platte, 11,948; Indianola, 11.845; Ft. Elliott, Tex., 11,050; Grand Haven, 10,875; Bismarck, 10,575; St. Louis, 9,499; Erie, 9,491; Red Bluff, 8,621; Cairo, 7,671; Punta Rassa, 7889. Frost-work prevented a complete record on Mt. Washington. The *smallest in various districts are*: El Paso, 2,546; Roseburg, 2,569; Augusta, 2,787; Uvade, 3,167; Tuscon, 3,448; Lynchburg, 3,794; Toledo, 4,083; Nashville, 4,140; Montgomery, 4,733; Little Rock, 5,118; Springfield, Mass., 5,163; Baltimore, 5,398; Dubuque, 6, 203; Escanaba, 6,804.

Local Storms.—Violent local storms, in unusual numbers, occurred during *April.* Tornadoes, causing loss of life or doing serious injury to property, were reported from Kansas and Louisiana on the 2nd; from Georgia on the 3rd, 4th and 24th; from Missouri, Arkansas, Iowa, Illinois and Wisconsin on the 18th and 24th; from Illinois on the 23rd; from Illinois and Missouri on the 24th, and from Mississippi on the 25th, 29th, 30th. The following details have been gathered from reports made by Signal Service and voluntary observers

and other sources more or less reliable. Ottawa, Kan., 2nd, about 6 p. m., severe tornado, destroying much property, injuring 15 persons and killing several. Just before the storm dark and angry-looking clouds formed suddenly in the W. and NW., and as they drew near seven houses were first demolished. The cloud, then bouncing over a space of 400 feet, unroofed a freight depot and overturned two railway cars, injuring seriously several passengers. The path of the storm was narrow; the direction from SW. to NE. Girard, Kan., 2nd, 7 p. m., tornado apparently developed seven miles to the southwest and moved northeastward to within one mile of the town, where its course was changed to east, moving thence directly to the Missouri line; track 3 to 50 rods wide; 3 persons killed, many others badly hurt and 17 houses destroyed. Shreveport, La., 2nd, p. m., violent thunder-storm and tornado, 3 persons injured and 15 buildings destroyed; path one mile long and ¼ mile wide; shape, parabolic curve. Loud roaring preceded storm. Debris on S. side fell to W. or N. side to E. Dalton, Whitefield Co., Ga., 3rd, p. m., tornado passed 6 miles north of town, extending across Connasauga river into Murray Co.; two persons killed, many injured and 18 houses completely demolished; path about one mile wide; two opposing currents of wind were observable during the progress of the storm, one from the west, the other and the most violent from the east. This tornado crossed Grass mountain near the point at which a similar storm passed in 1878. 3rd, near midnight tornado and waterspout between Mount Airy and Toccoa, Ga. It passed through Murray county reaching Cheroke, 100 miles distant, about 2 a. m. Hail reported as large as a mans fist. The county is sparcely settled, yet 50 dwelling of all kinds were levelled, 3 persons killed and many badly injured. A hog was found 40 feet from the ground in the fork of a tree. Length of path unknown; average width about one mile. Remarkable amount of rain reported, but no figures given. Elbert Co., Ga., 3rd, tornado, passed through north part of county, blowing down many houses and the largest trees. Its passage resembled a cloud of smoke and fire rolling on the ground. Washington Co., Ga., 4th, during afternoon, tornado passed through southwestern portion of county, demolishing many buildings, track ¼ mile wide; direction SW to NE. Edgefield, S. C., 6th, 5 p. m., "most terrible storm of wind ever remembered." Trees and houses were swept away; several persons slightly and one seriously injured. Through one large forest, trees were twisted off or uprooted "that had stood for ages." In Mississippi, 15th, p. m., a severe storm swept over Natchez and vicinity, unroofing buildings, uprooting trees and demolishing fences and outhouses. The rain fell in torrents, sweeping away bridges, etc. All telegraphic communication was interrupted for three days. Wheeling, W. Va., 16th, high storm, culminating in a violent due E. wind at 5 p. m. Two freight depots unroofed and several other buildings seriously damaged. High winds were felt through entire central and southern parts of Ohio; At Newark, New Philadelphia, Canal Dover, Milford Center, Springfield, Snyder's Mills, Taylorsville, Columbus, Cincinnati, Martinsville, Bellaire and Lebanon, buildings were unroofed or blown down and much damage was done to other property. Corwin Center, Bradford and Oil City, Pa., 16th, destructive wind-storm, demolishing derricks and unroofing buildings; two men seriously injured. Buffalo, N. Y., 16th, violent wind-storm from SW.; several buildings damaged; heavy weather on Lake Erie; several vessels injured, one sunk. Harrisburg, Pa., 16th, violent wind-storm; covered bridge over the Susquehanna river blown in; several buildings more or less damaged. Beloit, Wis., 18th, about 5 p. m., severe tornado swept over the city from SW. to NE.; houses and other buildings destroyed; many persons injured and several killed. Loss to property estimated at $75.000. Stiles, Davis Co., Ia., 18th, tornado passed from SW. to NE. through the town and adjoining country, causing great destruction to property; path 20 miles long and from 50 to 300 yards wide; accompanied by heavy hail and floods of water. Bloomfield, Ia., 18th, during afternoon a tornado, causing great destruction to buildings, fences, &c., passed 4 miles north of town in a direction from SW. to NE.; no lives were lost. Greenville, Bond Co., Ill., 18th, furious tornado, almost every portion of the city was more or less injured; numerous houses, &c., were demolished and torn to pieces; several persons seriously injured, but none killed. In and near Decatur, Macon Co., Ill., 18th, violent wind-storm, blowing down trees, and buildings. Wenona, Marshall Co., Warren, Jo Daviess Co., Ill., 18th, violent wind and rain storm; many buildings demolished; no lives lost. Champaign, Ill., 18th, old university building badly wrecked and many other buildings partially demolished. Ottawa, La Salle, Co., Ill., 18th, during the evening a violent storm of wind and rain, causing much destruction. Peoria, Co., Ill., 18th, heaviest storm of wind and rain experienced for many years; many buildings damaged. Summerfield, St. Clair Co., Ill., 18th, very violent storm of wind, rain and hail; much damage to trees and buildings. Jacksonville, Morgan Co., Ill., 18th, terrible storm of wind and rain; the roof of county poor house blown off, large ice house torn to pieces and the bridge across Big Sandy river swept away. Tuscola, Douglass Co., Ill., 19th, about 2 a. m. "a most terrific wind and rain storm," with vivid lightning. Many buildings demolished. Lyndon, Ill., 18th, violent tornado moved NE. from extreme west part of Whiteside Co., demolishing 6 buildings; surface wind of SE. 30 miles prevailed. A funnel shaped cloud hung in rear of path, sometimes absorbed by clouds and again descending destroyed everything in its path. On April 18th, 1869, a tornado passed over almost the same ground. Clinton, De Witt Co., Ill., 18th, about midnight a very violent wind-storm caused considerable damage to buildings. Collinsville, Madison, Co., Ill., 18th, violent wind-storm accompanied by heavy thunder and vivid lightning, rail-road depot completely destroyed. Chester, Randolph Co., Ill., 18th, several houses unroofed and much other property badly damaged. One person seriously injured. Davenport, Ia., 18th, "wind blew terrific gale," making it unsafe to swing the draw of the government bridge; ferry boats could not cross the river. Much damage to buildings and other property. The following data relative to the remarkably violent storms in connection with low area No. X, that prevailed throughout the Lower Missouri and Central Mississippi valleys on

the afternoon and night of the 18th, has been compiled. In *Missouri* the following places were more or less devastated by a series of separate tornadoes the paths of which ran from SW. to NE., and were distributed over a narrow strip of country, having an average width of about 80 miles. The most destructive or what is known as the Marshfield tornado, was first *reported* as appearing in Barry county, Missouri, near the Arkansas line, where ten persons were killed in the Crow creek settlement and six on Flat creek. It moved thence northeastward passed six miles south of Springfield, Green Co., reaching Marshfield, Webster Co., about 6 p. m. All of the buildings, brick and frame in this city of nearly 2,000 inhabitants, were demolished except half-a-dozen, the ruins taking fire during the prevalence of the storm; 65 persons were killed and about 200 wounded. In the vicinity of the town the violence of the storm was such that trees three feet in diameter were for a space of several hundred yards wide lifted entirely out of the ground, limbs twisted off and split into kindling wood, and the bark of trees peeled off as if struck by lightning. Loss of property in these two counties estimated at over one million dollars. After leaving Marshfield the tornado struck the St. Louis and S. F. R. R. ten miles east, with greatly diminished force, and at about 8 p. m. reached Franks station 110 miles ENE. of Springfield, where after crossing the Gasconade river, it continued only as a heavy storm of wind and rain. At Conway, Laclede Co., one house blown down and two children killed. In Panther valley, Webster Co., seven persons reported killed and large amount of property destroyed by a tornado which passed northeastward about 20 minutes later than the Marshfield storm. At Licking, Texas Co., the entire town was destroyed, except three houses; 300 persons were left homeless; one person killed and 17 wounded, 5 of them seriously. The loss to property is estimated $50.000. At Cuba, Crawford, Co., the town and surrounding country were nearly laid waste. In the vicinity of Jefferson City about 60 miles NW. of the line of the Marshfield tornado, another series of violent storms devastated portions of Morgan, Cole, Montieau and Callaway countys, on the night of the 18th. At New Bloomfield, Callaway county, 10 houses and one church were destroyed, several persons injured and one killed. The town of Barnettsville, Morgan Co., was nearly torn to pieces; several persons killed and many wounded. The surrounding country was strewn with fragments of demolished buildings. At Russellville, Cole Co., great destruction to property occurred; several persons killed and many injured. One of the tornadoes crossed the Missouri Pacific R. R., near Scotts station causing considerable destruction to property, 10 persons were seriously injured. Ten miles SW. of Fulton, Callaway Co., the tornado made great havoc among the farm houses in the line of the storm; 2 persons were killed and 8 wounded. At Carrington, Callaway Co., several houses were unroofed and other property destroyed. The tornado moved nearly due north in this vicinity for three or four miles demolishing everything in its course. Those who were near describe the appearance of the clouds as "terrible," and the noise as the sound of "10,000 express trains." Regarding the storms in that state the Missouri Weather Service, says: "The average width of its (Finley Creek Valley storm) destructive path for a distance of 100 miles would be at least 3,000 feet." "The destructive path of this (Marshfield) storm was about 45 miles long and on the average 1,500 feet wide." The area covered by these three storms will not fall short of 80 square miles. Not less than 100 persons lost their lives." In *Kansas* the violent local storms of the 18th were confined to the eastern tier of counties, and occurred between 3 and 4 p. m. At Leavenworth several buildings were unroofed, one person was seriously injured. At Lawrence the worst wind-storm ever known, the measured wind velocity at the State University from 3:30 to 3:45 p. m. reaching a maximum of 80 miles per hour. The roof of the University building was damaged, large number of buildings unroofed or blown over. At Shawnee Mission, Johnson Co., a violent wind storm prevailed between 4 and 5 p. m., demolishing several buildings and injuring 5 persons. In *Arkansas* the storms of the 18th only visited the northern half of the State. At Fayetteville, Washington, Co., the tornado struck about 8:30 p. m. passing through the town from SW. to NE., the track was about 100 yards wide and not a single building in its course escaped destruction or injury. Buildings, fences and trees were levelled to the ground and the fragments scattered in every direction. Over 100 buildings destroyed, two persons killed and 20 to 30 injured, many of them seriously. The loss to property is reported to be over $100,000. Goshen, 12 miles northeast of Fayetteville, was struck later by the tornado and almost entirely swept away. At Eureka Springs, 20 miles northeast of Fayetteville, 18 houses were demolished, one person killed and several injured. In Franklin county, near Ozark, a violent storm of wind, rain and hail prevailed from 6:40 to 7 p. m., the roar of the storm was dreadful, and its destruction complete. The damage among the farming community was very great. El Paso, White county, was struck by a violent tornado at 8 p. m., ten persons were killed and twenty injured. The path of the storm was about ¼ mile in width and passed from SW. to NE.; the devastation, throughout its entire course, was complete. The town of Dardenelles, in the northeastern portion of Yell county, was partly destroyed, about 8 p. m., by a violent storm. 18th, severe wind and rain-storm in Chester, Eaton county, S. C., demolishing several buildings and killing live stock. Track of storm ¼ mile wide. In Indiana, violent local wind-storms were experienced, but the time of their occurrence was early on the morning of the 19th. At Richmond, Wayne Co., the wind was exceedingly violent, several houses were blown down and unroofed; great damage was caused to buildings and telegraph lines throughout the Whitewater valley. A violent wind-storm reached Wabash about 4 a. m., causing considerable damage to buildings, fences, &c., along the southern boundary of *Wisconsin* the violent tornadoes of the 18th were experienced about 5 p. m. At Shopiere, Rock Co., 23 buildings were unroofed or destroyed; stock killed, and several persons injured. The path of the storm was quite narrow

and its direction from SW. to NE. In the vicinity of Turtleville, Rock Co., the tornado was equally severe. Those who witnessed its approach from the SW., said that it appeared much like a "turbulent mass or wall of clouds, in color varying from gray to black, and moving somewhat in the form of eddies or small whirlwinds, some rising, some falling, the whole moving at a rapid space, gathering up all loose rubbish, hurling it in every direction. There was a steady ominous roar unlike anything ever heard before, resembling both the screech of a bomb shell and the rumble of many heavy-laden rail-road trains." At Rockton, just across the Illinois line, the tornado was severely felt. The premonitions of an unusual storm were clearly evident in the huge masses of dark clouds piling up in the W. and NW., together with the rapid shifting of the conflicting air currents. Clouds were seen to "whirl, twist and fly in all directions, some chasing swift toward the NW. in solid masses, lighter ones curling gracefully up toward the zenith, working back and forth across the face of the heavier masses, while others swept toward the NE. and E. causing an intermingling of the wildest confusion." Portions of the path of this storm appeared to disclose a zigzag course of the storm cloud, as if in its progressive movement it swung from side to side.. The general direction was from SW. to NE. and varied in width from ¼ to ½ mile. On the 24th at about 7:30 p. m., a violent tornado entered Lima township, Adams Co., Ill., from Lewis Co., Mo., passing northeastward through the northern portions of Keene and Houston townships. The storm-cloud was very black, funnel shaped, and moved with great velocity like a screw propellor; path ½ mile wide, everything swept before it; 5 persons seriously injured. Taylorville, Christian Co., Ill., 7 p. m., storm passed from SW. to NE. First observed as a funnel shaped clond gradually approaching the earth, which struck near Sharpsburg, where it demolished everything in its path for a distance of 8 miles; width of track ¼ to ½ mile; 6 persons killed and 20 injured. Hundreds of horses and cattle killed or seriously injured, and 25 farm houses destroyed. Carlinville, Macoupin Co., Ill., 24th, about 6:30 p. m., "terrific" wind-storm passed 2 miles north, crossing the Chicago and Alton R. R., demolishing houses, barns, fences and orchards. Joplin City, Jasper Co., Mo., 24th, about 5 p. m., terrible tornado, barns, hoisters, engine rooms and buildings through the mines all demolished; 12 houses blown down and several persons injured. Webb City 5 miles north was completely wrecked. Macon, Miss., 25th, 8:30 p. m., terrible tornado demolishing 22 houses and other buildings, including all railroad shops and depots, 16 box cars were blown from the track, many of them turned bottom side up; 22 persons were killed and 72 injured. The damage to property was estimated at $100,000. One house near the centre of the storm was whirled around and its front changed in exactly the opposite direction. A pair of car trucks weighing 8,000 pounds were lifted 200 yards from the track. The first approach of the storm was indicated by "peculiar black clouds in the SW. and NE. rushing toward each other, and when nearly together two balls of fire appeared to leave them and unite with a terrible roar, when the storm burst." It did not seem to come from across the country, but suddenly shot downward from the air, devastating the city in about three minutes. Paint Rock, Jackson Co., Ala., 25th, many houses and barns destroyed, and three children killed; width of track 75 yards. Giles Co., Tenn., 25th, great damage done buildings and stock. Dalton, Whitefield Co., Ga., 25th, about sundown several houses unroofed and much damage to other property; width of track ¼ to ½ mile. Mayersville, Issaquena Co., Miss., 22nd, about 1:30 a. m., very violent wind and rain storm continued for 10 to 15 minutes, blowing down houses, fences, stables and trees. Near Griffin, Spaulding Co., Ga., 20th, between 7 and 8 a. m., violent tornado accompanied with a dull roaring noise and funnel-shaped cloud, passed from SW. to NE. destroying fences and unroofing trees over a path about 50 yards wide and 2 miles in length. In some places the cloud rose from the ground, and skimmed along over the tops of trees, twisting off only the upper limbs. Grassy Cove, Cumberland county, Tenn., 25th, 7:30 p. m., destroying several buildings, uprooting trees and demolishing fences. In a large forest to the rear of the town hundreds of the stoutest trees were torn up by the roots or twisted off near the ground with the greatest violence. Dawson, Sangamon county, Ill., 24th, 10 p. m., several buildings destroyed and much fencing blown down. In many instances fences running north and south were, at points, first thrown to the east and then at a short distance almost the same length of fencing thrown to the west, showing a cyclonic action of the storm. Fences running east and west were alternately thrown north and south. Direction of storm N. 70° E. At Medova, Rockbridge, Chesterfield and Anderson Switch, Macoupin county, Rochester, Sangamon county, Tuscola, Douglass county, Ashland, Cass county, Farmer City, DeWitt county and Kankakee, Kankakee county very violent wind and rain storms occurred during the evening of the 24th, causing immense damage to property and stock. Oskaloosa, Miss., 28th, high wind, blowing down several houses (some old) in Jackson, Winn and Ouachita parishes. Columbia, S. C., 29th, 4 p. m., terrific tornado, several persons injured and many buildings blown down. Track a few hundred yards in width, direction from SW. to NE. At Plano, Kinney, Melissa, Brenhan, Granville and Davilla, Tex., 29th, violent wind storms, blowing down houses, destroying much property and injuring several persons. Yazoo City, Miss., violent wind storm demolishing buildings, trees and fences; track very narrow, SW. to NE.

VERIFICATIONS.

Indications.—The detailed comparison of the tri-daily indications for March, with the telegraphic reports for the succeeding twenty-four hours, shows the general percentage of verifications to be 82.3 per cent. The percentages for the four elements are: Weather, 87.8; Direction of the Wind, 78.0; Temperature, 79.9; Barometer, 82.9 per cent. By geographical districts they are: for New England, 81.6; Middle States, 84.7; South Atlantic States, 83.5; Eastern Gulf States, 83.9; Western Gulf States, 81.8; Lower Lake region, 84.5; Upper Lake region, 79.9; Tennessee and the Ohio valley, 84.9; Upper Mississippi

valley, 80.9; Lower Missouri valley, 76.8; Northern Pacific region, 86.1; Central Pacific coast region, 83.9; Southern Pacific coast region, 83.9. There were 20 omissions to predict out of 3,790, or 0.54 per cent. Of the 3,670 predictions that have been made, 89, or 2.42 per cent, are considered to have entirely failed; 169, or 4.60 per cent, were one-fourth verified; 544, or 14.82 per cent, were one-half verified; 647, or 17.63 per cent, were three-fourths verified; 2,221, or 62.51 per cent, were fully verified, so far as can be ascertained from the tri-daily weather maps.

Cautionary Signals.—292 Cautionary Signals were displayed during the month, of which 254, or 87.0 per cent., were justified by winds of 25 miles per hour or over at, or within a radius of 100 miles of the station. 104 Off-shore Signals were displayed, of which 91, or 87.5 per cent, were fully justified; 96, or 92.3 per cent, were justified as to velocity; 94, or 90.4 per cent as to direction; and 5, or 4.8 per cent, were not justified either as to direction or velocity. 45 of the Off-shore were changed from Cautionary. 396 Signals of both kinds were displayed, of which 345, or 87.1 per cent, were fully justified. The above does not include signals ordered for 50 display stations, where the velocity is only estimated. 89 cases of winds of 25 miles and over per hour, from scattering stations, were reported, and for which signals had not been ordered.

NAVIGATION.

In the table on the right-hand side of chart No. III are given the highest and lowest readings of the Signal Service river gauges for the month, with the dates of the same. The *Red River* at Shreveport fell slowly throughout the month. The *Arkansas* at Little Rock remained comparatively low throughout the month, the highest water occurring on the 9th; at Fort Gibson on the 3rd Grand River was higher than for 2 years past. In the *Missouri* the highest water occurred at Omaha on the 6th and Leavenworth on the 7th; the water fell about 7 feet at former and 5 feet at latter station during the following week, and remained almost stationary to end of month. The *Mississippi* from St. Paul to Keokuk had its lowest water on the 1st, after which it rose somewhat, but did not present any very high water throughout the month; the observer at Dubuque, however, reports the water on the 17th and 18th the highest since 1875; at Cairo the water fell from the 1st to the 16th; remained almost stationary to the 29th, when a rapid rise set in from the Ohio; at Memphis it fell throughout the month; at Vicksburg and New Orleans the water continued very high and above the danger-line throughout the entire month and much damage occurred, which is noted under "Floods." The *Ohio* at Pittsburgh, Cincinnati and Louisville fell slowly from 1st to 23d or 24th; after which a rapid rise occurred, reaching the maximum at Pittsburgh on the 27th, Cincinnati on the 29th and Louisville on the 30th. The *Cumberland* at Nashville generally fell until the 15th, rose to its highest point by the 20th and fell to end. The *Tennessee* at Chattanooga had the highest water on the 5th, fell to the 15th and after a slight rise remained almost stationary to end.

Ice in River and Harbor, &c.—The following notes on the breaking up of ice and opening of navigation are reported by observers: *Missouri.*—Ft. Hale, Dak., 9th, first steamboat. Omaha, 5th, navigation opened; 23rd, first steamer up. Leavenworth, 6th, first steamer. *Mississippi.*—St. Paul, 14th, first steamboat arrived. *Red River of the North.*—Pembina, 16th, ice moved, and on 23rd went out and navigation opened. 27th, first steamboat. *Lake Superior.*—Duluth, 15th, ice broke up in lake, but on 22nd the harbor was again filled with ice. Marquette, 11th, ice broke around docks; steamers and barges arrived on the 28th. *Lake Michigan.*—Escanaba, 13th, the first steamers broke their way through the ice. *Lake Huron.*—On the 6th the first fleet of vessels coming through Makinac straits arrived at Port Huron. *Erie Canal*—opened at Rochester on the 17th, and Albany on the 19th. At Buffalo canal navigation opened on the 20th. *Otsego Lake.*—Cooperstown. 7th. lake open. *Lake Champlain.*—Burlington, floating ice in lake and harbor to the 8th. *Kennebec River.*—Gardiner, Me., open on 3rd, first steamer on 5th. Closed 110 days. *Lake Massabesic.*—Auburn, N. H., 9th, free of ice.

High Tides.—Baltimore, 30th, very high. At Buffalo, N. Y., on the 10th, the water in Lake Erie rose 6 feet, and was higher than for 20 years past.

Low Tides.—New River, N. C., 15th, very low.

TEMPERATURE OF WATER.

The temperature of water as observed in rivers and harbors, with average depth at which observations were taken, is given in the table on the left-hand side of chart No. II. At the following stations observations were not made, either on account of ice or loss of thermometer, on the dates indicated: Alpena, 1st to 15th; Escanaba, 1st to 19th; Marquette, 1st to 10th, 16th and 17th; San Francisco, 2nd to 30th. Lake too rough for observation at Cleveland, 10th and 11th. At Chincoteague, Va., observations were commenced on the 14th. The *March* temperatures for Punta Rassa are: Max., 80°; min., 68°; average depth, 13 feet.

ATMOSPHERIC ELECTRICITY.

Thunder-storms were of remarkable frequency during the month, but lack of space prevents their enumeration in detail.

Auroras.—During April, 1880, two general displays occurred—on the 1st and 28th, in each case extending from Eastport, Maine to Bismarck, Dakota; New Haven was the most southerly station reporting on either date. On the 1st the display generally prevailed from 9 p. m., Washington mean time, till after midnight. Eastport, Me., bright yellow; arch, 40° altitude. Grafton, N. H., faint white. Windsor, Vt., faint diffuse light, changing to arch 18° high, with segment. Burlington, Vt., bright diffuse arch of light,

pale straw color. New Haven, arch of pale white light 10° alt., 30° azimuth. Newburyport, Mass., bright segment, 15° azimuth, with quivering motion, rays shooting upward to 20° alt. Waterburg, N. Y., 10° alt. North Volney and Argyle, N. Y., diffuse light. Oswego, diffuse yellow light. Buffalo, faint motionless light above a dark segment of 20° alt., 6° breadth and from 160° to 200° azimuth; beams brighter near midnight. Marquette, Mich., faint. Pembina, Dak., broad band of brilliant white light from 170° to 270° az., altitude, 30°. Sometimes a second arch formed 10° under the first; at such times the upper arch faded while the second rose with increasing brilliance, occasionally sending rays of short duration upward across the first arch. Bismarck, segment of nebulous light, 15° alt., with few streamers. 28th.—The display generally prevailed from 8 p. m., Washington mean time till after midnight. Eastport. Me., arch from NW. to NE.; alt. 35°. Gardiner, Me., faint, without beams, 60° az. Cambridge, Mass., suspected. Grafton, N.H., very bright. Burlington, Vt., pale emerald green light of marked intensity; a dark segment and bright arch with frequent streamers changing near midnight to steady light. New Haven, well defined dark segment almost black, with no arch or crown; color delicate rose; streamers of steady light with variable brightness and altitude occasionally shooting up to 30°. Ardenia, Waterburg and Argyle, N. Y., faint and diffuse. Pembina, from 170° to 260° az., pale diffuse light with no distinct outlines; light being brightest at its summit, 40°. Light brilliant enough to cast a faint shadow. Bismarck, Dak., faint; altitude 10°; one stationary beam in NNE. section. On the 2nd a display was visible at Eastport, Me., pale yellow. Grafton, N. H., and Burlington, Vt., bright arch with few streamers, but no dark segment. 4th, at Pembina, Dak., faint. The following reports, *March*, were received too late for publication in that *Review:* Eola, Oregon, 6th, very faint. Ft. Assinaboine, Montana, 12th, 9.15 p. m., extending from E. to W. Three parallel arches, two upper very distinct, lowest faint. Twelve luminous beams shot upward from the highest arch. One beam resembled a bluish flame, and continued with great splendor for 45 minutes. 17th, 10 p. m., lasting 40 minutes, aurora arch of irregular and sinuous bands of variable curves, with rapid undulating motion from E. to W. Bright beams shot upward from arch, lasting but few moments. Thornville, Mich., 17th, 9 to 10 p. m., few beams, no dark segment. In connection with the extensive display (from Maine to Montana) of March 27th it is noted as of interest that at 9 p. m. an aurora was seen at Edinburgh, Scotland. It was a low arch of quiescent light, breaking up at 11 p. m. into bright pellets, which sent upwards fainter rays, and then gradually disappeared.

Atmospheric Electricity.—Pembina, Dak., 3rd, during a snow storm a constant band of flame, accompanied by a loud buzzing sound, continued for nearly an hour between the points of the lightning arrester. Omaha, 13th, telegraph wire highly charged with electricity for whole day during a violent dust-storm. Mt. Washington, N. H., 10th, strong shocks of electricity felt from anemometer through two pair mittens, one of buckskin.

MISCELLANEOUS PHENOMENA.

Sunsets.—The characteristics of the sky at sunset as indicative of fair or foul weather for the succeeding twenty-four hours have been observed at all Signal Service Stations. Reports from 133 stations show 3,901 observations to have been made, of which 30 were reported doubtful; of the remainder, 3,265 or 84.3 per cent. were followed by the expected weather.

Zodiacal Light.—Harvard College, Cambridge, Mass., looked for daily; distinct, 5th, 8th; visible, 7th, 10th; suspected, 26th. Wytheville, Va., 4th, 5th; very bright, broad cone, 8th. Mr. Chas. Hasselbrink, observer, at Havana, Cuba, reports: April 1st, 8 p. m., visible about 20° above horizon, of irregular elliptical shape, with large axis, inclined to north; 8:15 p. m., diminished and, at 9 p. m., disappeared. 3rd, light glare, of triangular shape, from 8:30 to 9:20 p. m. 6th, light, fairly visible, about 7:25 p. m.—stands about 27° high—without determined shape, and inclined (2° to 3°) to north; after 8:15 p. m. indifferent glare till disappearance. The following are a number of conclusions arrived at by Mr. Hasselbrink. (1) The zodiacal light is visible at Havana whenever the circumstances are favorable, that is, when there is neither cloudiness nor moonshine; (2) it presents a translucent, reddish, yellowish veil, which partly or feebly masks the sky, and when it decreases in brightness various stars become visible; (3) the intermittence in its intensity is characteristic, can be noted always, and is generally surprisingly sudden—every increase of light seems a rapid effluvium; (4) the extension and form vary; sometimes it stands about 40° above horizon, and has somewhat the shape of an isosceles triangle, at other times it does not rise above 30°, widening at base and approaching equilateral triangle; (5) the light generally exceeds in brightness that of the milky way, and has a different character, being more uniform; (6) the duration is from 1½ to 2 hours; (7) direction of axis of light not yet determined—it appears at times inclined towards the north, at times has the same inclination towards the south, and sometimes appears perpendicular.

Meteors.—Woodstock, Md., 28th, 8:40 p. m., greenish color, large nucleus; exploded, but no noise heard. Cape Henry, Va., 1st, 10 p. m., lighting up entire heavens; course from SE. to N., visible 8 seconds; color pale blue, leaving train of bright yellow; exploded 35° above horizon; no noise heard.

Solar and Lunar Halos were reported in too large a number during April to permit of their enumeration in detail.

Prairie and Forest Fires.—In the vicinity of Lincoln, Sussex Co., Del., 13th, 5,000 acres burned over the first day. Pike and Monroe Cos, Pa., 14th, assumed alarming proportions; 25th, broke out afresh, causing great destruction of timber. In Monroe Co. nearly 2,000 acres burned over. Ocean Co., N. J., 14th, most extensive for years, area burnt over estimated at 60 square miles, extending from Bricksburg to Manchester; 18th, broke out again; Cape May and Cumberland Cos., 19th, disastrous fires broke out at Millville, Belle

Plain and Mt. Pleasant; fires still burning vigorously in Cape May, Cumberland and Atlantic Cos. Norfolk, Va., 15th, extensive fires in Dismal Swamp; enveloped Lake Drummond, preventing steamers from passing through the canal. Petersburg, Va., 15th, fires uncontrolable; in Prince George county very destructive. Dinwiddie, Chesterfield and Sussex Cos., 18th, reported beyond all control; losses very great; three persons burned to death. Port Jefferson, L. I., 21st, terrible forest fire swept away nearly the whole north portion of the town of Brookhaven, burning over 1,000 acres in the adjacent country.

Sun Spots.—The following record of observations, made by Mr. D. P. Todd, Assistant, has been forwarded by Prof. S. Newcomb, U. S. Navy, Superintendent, Nautical Almanac Office, Washington, D. C.:

Date—April, 1880.	No. of new—		Disappeared by solar rotation.		Reappeared by solar rotation.		Total number visible.		Remarks.
	Groups	Spots.	Groups	Spots.	Groups	Spots.	Groups	Spots.	
1st, 8 a. m...	0	0	0	0	0	0	3	10	Faculæ.
2nd, 8 a. m...	0	7	1	5	0	0	2	12	
4th, 2 p. m...	0	14†	0	0	0	0	2	26†	Faculæ. Many of the spots small.
5th, 8 a. m...	0	0	0	0	0	0	2	16†	
7th, 9 a. m...	0	0	.....	.....	0	0	1	3	Faculæ. Spots probably disappeared by solar rotation.
8th, 9 a. m...	0	0	0	0	0	0	1	3	
9th, 8 a. m...	1	2	0	0	0	0	2	5	Faculæ.
10th, 8 a. m...	1	5	0	0	0	0	3	10	Faculæ.
11th, 9 a. m	0	0	1	3	0	0	1	10	
13th, 7 a. m...	0	0	0	0	0	0	1	10	
13th, 8 a. m...	0	0	0	0	0	0	1	10	
14th, 8 a. m...	1	3	0	0	1	3	2	13	Faculæ.
15th, 8 a. m..	0	0	0	0	0	0	2	13	Faculæ.
17th, 7 a. m...	0	0	1	10	0	0	1	3	Spots small.
18th, 8 a. m...	0	0	0	0	0	0	1	3	Broad areas of faculæ.
20th, 5 p. m	1	1	0	0	0	0	2	4	Faculæ.
21st, 6 p. m...	0	2	0	0	0	0	2	6	
22nd, 4 p. m...	0	0	0	0	0	0	2	6	
23rd, 3 p. m...	0	0	0	0	0	0	0	0	
26th, 3 p. m...	1	8	0	0	0	0	1	8	
27th, 8 a. m...	0	10	0	0	0	0	1	18†	Faculæ.
28th, 7 a. m...	0	7	0	0	0	0	1	25†	Faculæ. Many of the spots small.
30th, 8 a. m..	0	0	0	0	0	0	1	25†	Many of the spots small.

†Approximated.

NOTES AND EXTRACTS.

Referring to the United States Signal Service Meteorological Charts, showing the mean pressure and temperature for July, 1878, *Nature*, of *April 15th*, says: "Thus then the meteorology of the globe for July, 1878, stands out as a singular phenomenon, characterized by these broad features, viz.:—(1) a greatly reduced pressure over a large portion of the Southern Hemisphere as compared with what usually obtains there in the winter month of July; (2) a much greater diminution of the pressure than usually takes place in the summer month of July over the land of the Northern Hemisphere, over North America, over Central and Eastern Europe, Western and Central Siberia; and (3) a much larger increase of pressure than usually occurs in the Northern Hemisphere over the great oceans in July, the area of unusually high pressure being extended, as regards the Atlantic to the northeast as far as Christiansund, and as regards the Pacific to westward over Central and Southern Asia, as far as the Arabian Sea. It may be worth remarking that this increased pressure over the oceans and diminished pressure over the land of the Northern Hemisphere is in accordance with what might be expected to result from an increased solar radiation; whilst on the other hand the increased pressure over Southern and Central Asia, and diminished pressure in the Southern Hemisphere, is not in direct accordance with this supposition. The point here referred to will however receive an illustration from subsequent numbers of the Weather Maps, by which it is probable that different results as regards the states of the atmosphere will appear, with the varying states of the sun from year to year. The future maps of this international series will be eagerly scanned in connection with many of the larger questions of atmospheric physics, as well as those directly practical questions of climate with which we have been almost exclusively concerned in this article. It is plain that we need not hope to succeed in dealing with most of the larger problems proposed by meteorology without the help of the data laid before us in so full and convenient a form by the International Weather Maps of General Myer. It is only thus that we can trace to their proximate causes such climatal phenomena as the recurring droughts of India and the cold, sunless summer of the British Isles in 1879, and show their true relations to the great movements of the atmosphere."

Published by order of the Secretary of War.

Albert J. Myer

Brig. Gen. (Bvt. Assg^d.) Chief Signal Officer, U. S. A.

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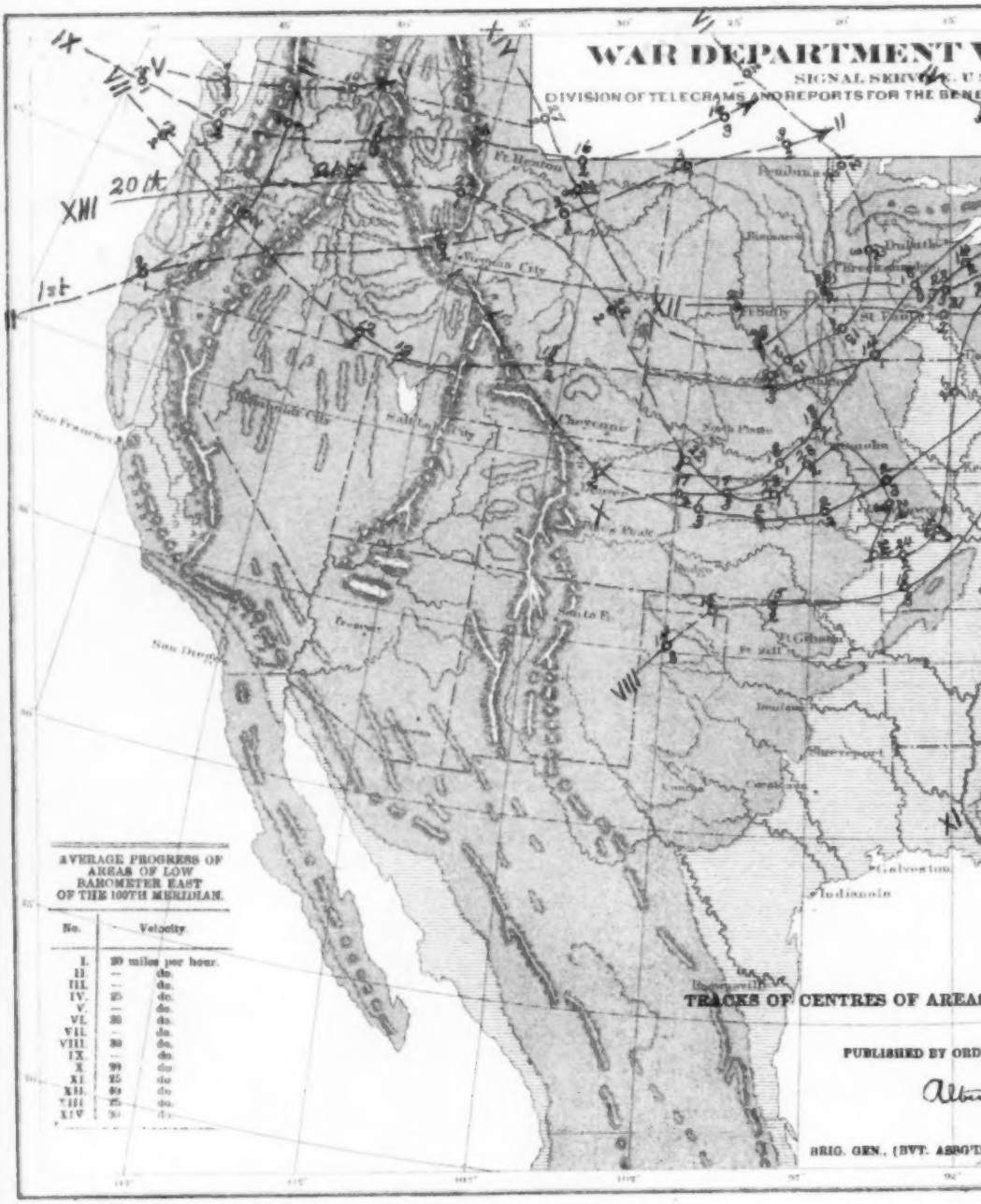
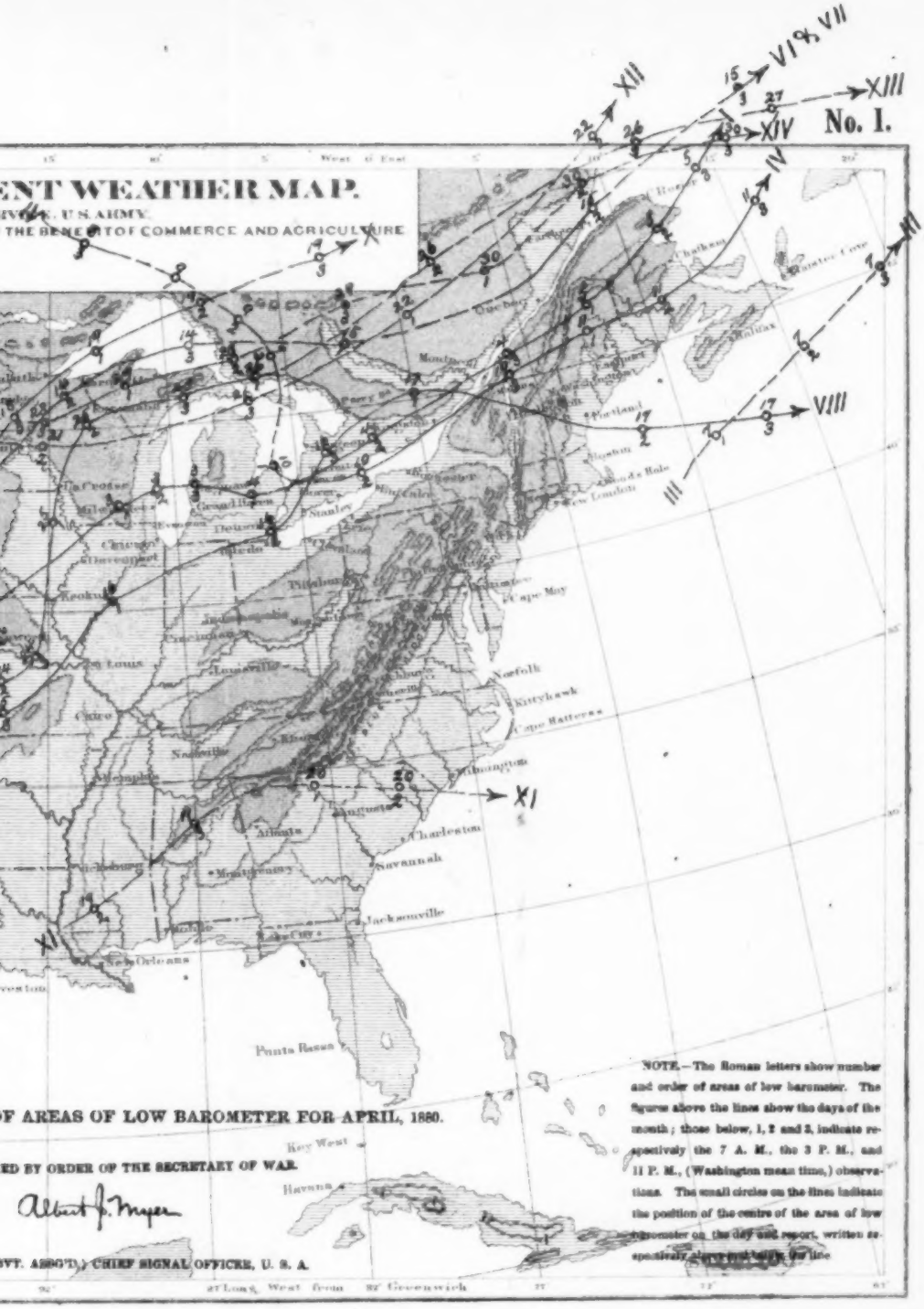

WAR DEPARTMENT
SIGNAL SERVICE, U
DIVISION OF TELEGRAMS AND REPORTS FOR THE BE
20th
XIII
1st
AVERAGE PROGRESS OF AREAS OF LOW BAROMETER EAST OF THE 100TH MERIDIAN.
No. Velocity
I. 20 miles per hour.
II. — do.
III. — do.
IV. 25 do.
V. — do.
VI. 30 do.
VII. — do.
VIII. 30 do.
IX. — do.
X. 20 do
XI 25 do
XII. 40 do
XIII 25 do.
XIV 30 do
TRACKS OF CENTRES OF AREA
PUBLISHED BY ORD
BRIG. GEN., (BVT. ASST'


No. I.
ENT WEATHER MAP.
RVICE, U.S.ARMY.
THE BENEFIT OF COMMERCE AND AGRICULTURE
XII
XIII
XIV
VI & VII
IV
V
VIII
III
II
XI
I
Boston
Portland
Cape May
Norfolk
Kittyhawk
Cape Hatteras
Charleston
Savannah
Jacksonville
New Orleans
Key West
Havana
Punta Rasa
OF AREAS OF LOW BAROMETER FOR APRIL, 1880.
NOTE.—The Roman letters show number and order of areas of low barometer. The figures above the lines show the days of the month; those below, 1, 2 and 3, indicate respectively the 7 A. M., the 3 P. M., and 11 P. M., (Washington mean time,) observations. The small circles on the lines indicate the position of the centre of the area of low barometer on the day and report, written respectively above and below the line
ED BY ORDER OF THE SECRETARY OF WAR.
Albert J. Myer
SVT. ASSG'T.) CHIEF SIGNAL OFFICER, U. S. A.
27 Long. West from 82° Greenwich

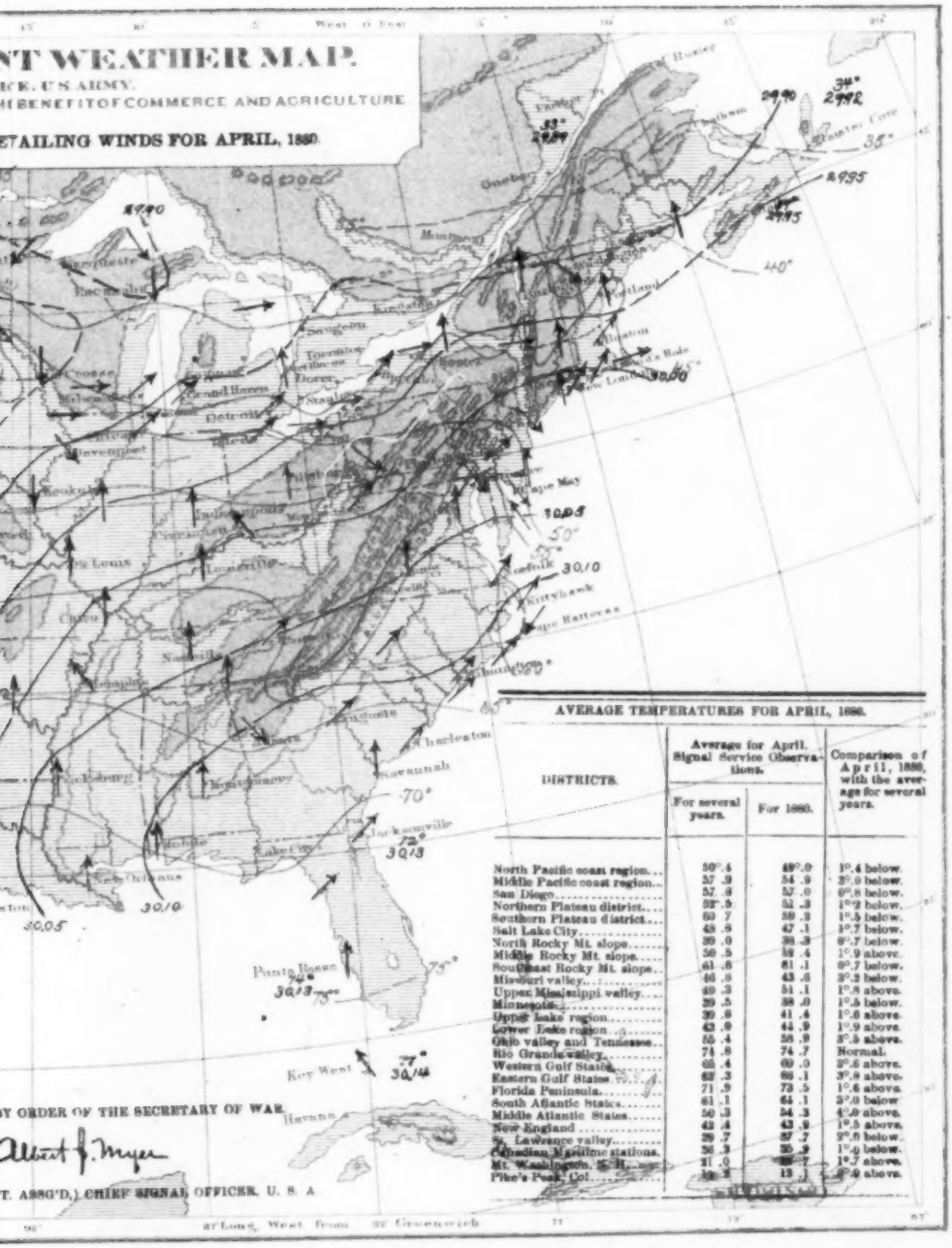
WAR DEPARTMENT W
SIGNAL SERVICE, U.S.
DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEF
ISOBARS, ISOTHERMS AND PREVAILING
PUBLISHED BY ORDER O
BRIG. GEN., (BVT. ASSG'D.)

TEMPERATURE OF WATER FOR APRIL, 1880.

STATIONS.	Temperature at bottom.		Average depth of water, in feet.
	Max.	Min.	
*Alpena	42°	39°	12
Augusta	73	58	11.7
Baltimore	58	44	11
Buffalo	52	38	10
Burlington, Vt.	39	33	10.5
Cedar Keys	—	—	—
Charleston	73	60.5	10.5
Chicago	50.5	42	8
*Chincoteague	60	56	9.3
*Cleveland	51	39	14
Detroit	47	38	25.7
*Duluth	—	—	—
Det. Breakwater	50	43	9.6
Eastport	57.5	34	12.6
*Escanaba	45	36	14
Galveston	75.5	65	14.5
Grand Haven	53	42	15
Jacksonville	80	66	16
Key West	82	74	14
*Marquette	36	33	9.7
*Milwaukee	49	41	8
Mobile	72	61	15.6
New London	48	40	17.5
New York	49	39	20.6
Norfolk	63	35	22.9
Portland, Maine	41.5	34.5	26.9
Punta Rasa	—	—	—
Sandusky	—	—	—
*San Francisco	—	—	—
Savannah	74	57	13.4
Smithville	71	50	10
Toledo	56	46	12.7
Wilmington	77	60	12.9
Wood's Holl	48	39	8

* Observations for only part of month—See page.

No. II.



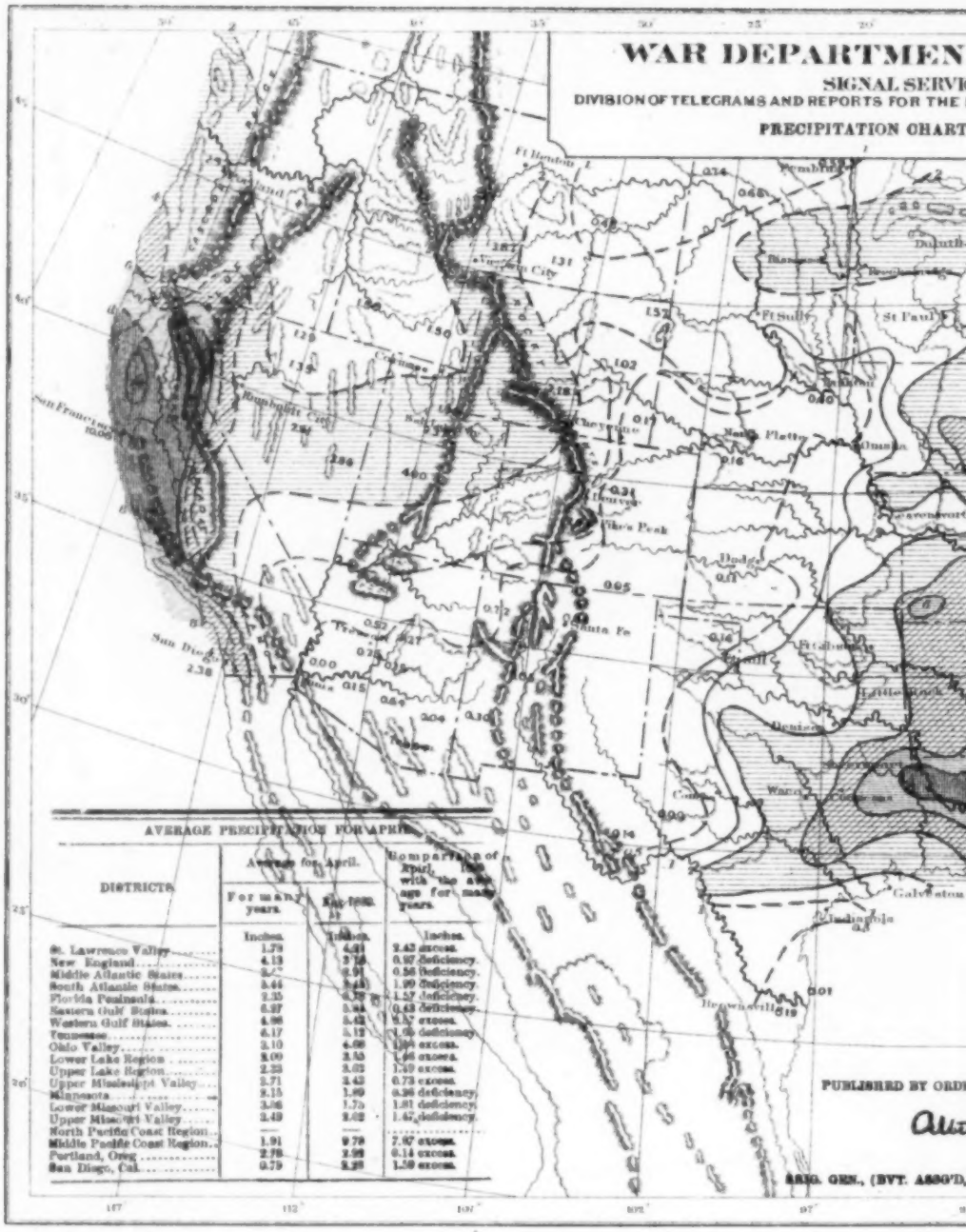
AVERAGE TEMPERATURES FOR APRIL, 1880.

DISTRICTS.	Average for April. Signal Service Observations.		Comparison of April, 1880, with the average for several years.
	For several years.	For 1880.	
North Pacific coast region	50°.4	49°.0	1°.4 below.
Middle Pacific coast region	57 .9	54 .9	3°.0 below.
San Diego	57 .6	57 .0	0°.6 below.
Northern Plateau district	57 .5	54 .3	1°.2 below.
Southern Plateau district	60 .7	59 .2	1°.5 below.
Salt Lake City	48 .8	47 .1	1°.7 below.
North Rocky Mt. slope	39 .0	38 .3	0°.7 below.
Middle Rocky Mt. slope	50 .5	52 .4	1°.9 above.
Southeast Rocky Mt. slope	61 .6	61 .1	0°.7 below.
Missouri valley	46 .8	43 .6	3°.2 below.
Upper Mississippi valley	49 .3	51 .1	1°.8 above.
Minnesota	39 .5	38 .0	1°.5 below.
Upper Lake region	39 .8	41 .4	1°.6 above.
Lower Lake region	43 .0	44 .9	1°.9 above.
Ohio valley and Tennessee	55 .4	58 .9	3°.5 above.
Rio Grande valley	74 .8	74 .7	Normal.
Western Gulf States	68 .4	69 .0	0°.6 above.
Eastern Gulf States	67 .3	69 .1	1°.8 above.
Florida Peninsula	71 .9	72 .5	1°.6 above.
South Atlantic States	61 .1	64 .1	3°.0 below.
Middle Atlantic States	50 .3	54 .3	4°.0 above.
New England	43 .4	43 .9	1°.5 above.
St. Lawrence valley	39 .7	37 .7	2°.0 below.
Canadian Maritime stations	36 .3	35 .9	1°.0 below.
Mt. Washington, N. H.	21 .0	22 .7	1°.7 above.
Pike's Peak, Col.	12 .3	13 .1	0°.8 above.

BY ORDER OF THE SECRETARY OF WAR.

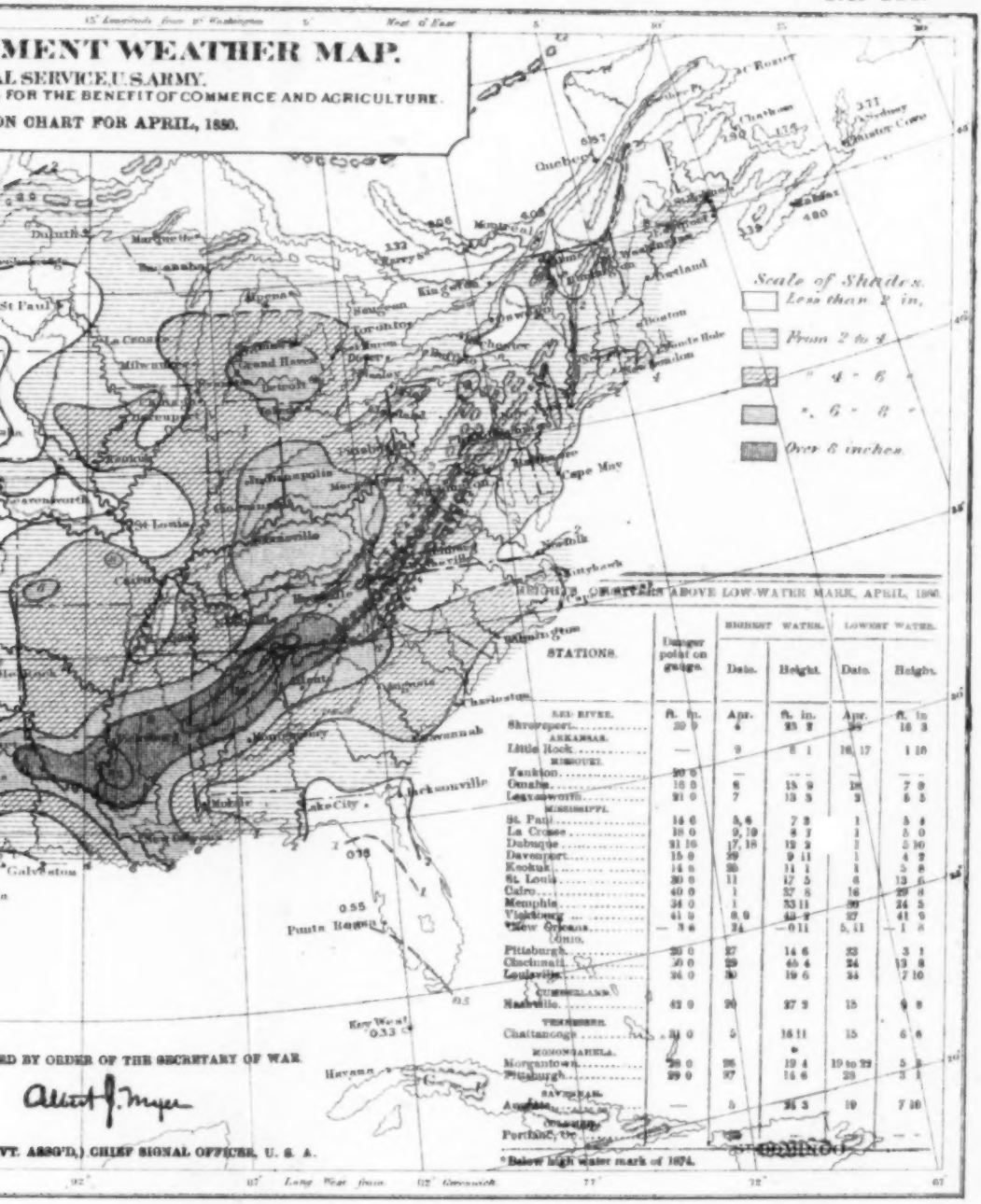
Albert J. Myer

BT. MAJ. GEN'L, CHIEF SIGNAL OFFICER, U. S. A.



AVERAGE PRECIPITATION FOR APRIL

DISTRICTS	Average for April. For many years.	Average for April. For 1882.	Comparison of April, 1882, with the average for many years.
	Inches.	Inches.	Inches.
St. Lawrence Valley	1.79	4.21	2.42 excess.
New England	4.13	3.16	0.97 deficiency.
Middle Atlantic States	3.[illegible]	3.01	0.56 deficiency.
South Atlantic States	3.44	1.45	1.99 deficiency.
Florida Peninsula	2.35	0.78	1.57 deficiency.
Eastern Gulf States	0.97	0.54	0.43 deficiency.
Western Gulf States	4.06	5.43	1.37 excess.
Tennessee	6.17	5.12	1.05 deficiency.
Ohio Valley	3.10	4.06	1.04 excess.
Lower Lake Region	3.09	3.55	1.46 excess.
Upper Lake Region	2.32	3.03	1.39 excess.
Upper Mississippi Valley	3.71	3.43	0.73 excess.
Minnesota	2.15	1.89	0.26 deficiency.
Lower Missouri Valley	3.06	1.75	1.31 deficiency.
Upper Missouri Valley	2.49	3.02	1.47 deficiency.
North Pacific Coast Region			
Middle Pacific Coast Region	1.91	9.79	7.87 excess.
Portland, Oreg	2.78	2.92	0.14 excess.
San Diego, Cal	0.79	2.29	1.50 excess.


MENT WEATHER MAP.
AL SERVICE, U.S. ARMY.
FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.
ON CHART FOR APRIL, 1880.
Scale of Shades.
Less than 2 in.
From 2 to 4 "
4 " 6 "
6 " 8 "
Over 8 inches.
Duluth
St Paul
La Crosse
Milwaukee
Grand Haven
Detroit
Chicago
Cleveland
Buffalo
Rochester
Oswego
Toronto
Kingston
Montreal
Quebec
Portland
Boston
Albany
Worcester
Hartford
Providence
New Haven
New York
Cape May
Atlantic City
Trenton
Philadelphia
Wilmington
Baltimore
Washington
Harrisburg
Pittsburgh
Parkersburg
Cincinnati
Louisville
Evansville
St Louis
Cairo
Memphis
Vicksburg
Natchez
New Orleans
Mobile
Jacksonville
Savannah
Charleston
Wilmington
Lake City
Punta Rassa
Key West
Havana
Galveston
HEIGHTS OF WATER ABOVE LOW-WATER MARK, APRIL, 1880.
STATIONS.
Danger point on gauge.
HIGHEST WATER.
LOWEST WATER.
Date.
Height.
Date.
Height.
RED RIVER.
Shreveport
ARKANSAS.
Little Rock
MISSOURI.
Yankton
Omaha
Leavenworth
MISSISSIPPI.
St. Paul
La Crosse
Dubuque
Davenport
Keokuk
St. Louis
Cairo
Memphis
Vicksburg
New Orleans
OHIO.
Pittsburgh
Cincinnati
Louisville
CUMBERLAND.
Nashville
TENNESSEE.
Chattanooga
MONONGAHELA.
Morgantown
Pittsburgh
SAVANNAH.
Augusta
ORANGE.
Portland, Oregon
* Below high water mark of 1874.
RD BY ORDER OF THE SECRETARY OF WAR.
Albert J. Myer
VT. ASSO'D.) CHIEF SIGNAL OFFICER, U. S. A.
Long. West from Greenwich

WINDS ACCOMPANYING THE ATLANTIC STORMS

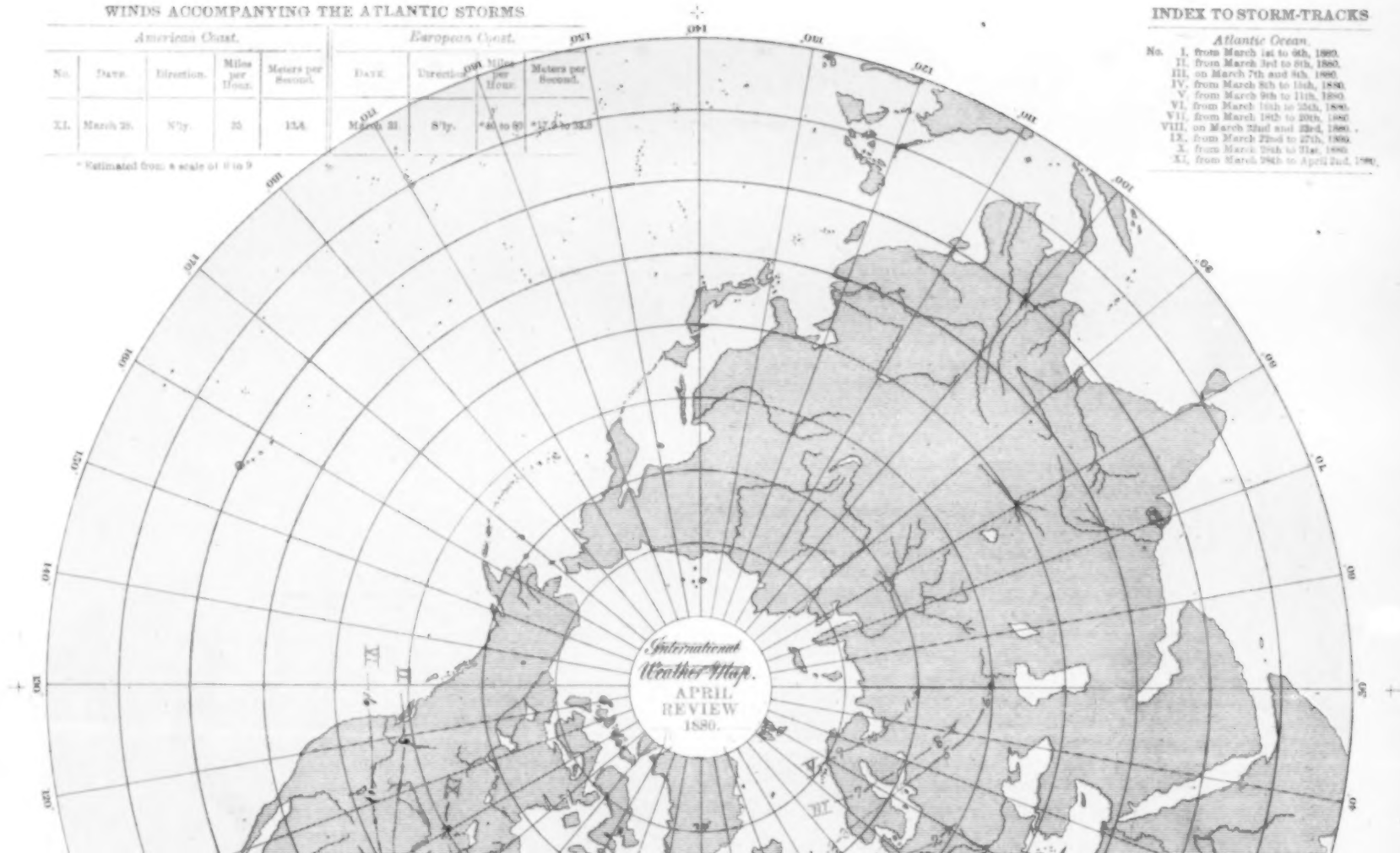
American Coast.					European Coast.			
No.	Date.	Direction.	Miles per Hour.	Meters per Second.	Date.	Direction.	Miles per Hour.	Meters per Second.
XI.	March 28.	N'ly.	35	15.6	March 31	S'ly.	*40 to 60	*17.9 to 26.8

* Estimated from a scale of 0 to 9

INDEX TO STORM-TRACKS

Atlantic Ocean.

No. I. from March 1st to 6th, 1880.
II. from March 3rd to 8th, 1880.
III. on March 7th and 8th, 1880.
IV. from March 8th to 15th, 1880.
V. from March 9th to 11th, 1880.
VI. from March 16th to 25th, 1880.
VII. from March 18th to 20th, 1880.
VIII. on March 22nd and 23rd, 1880.
IX. from March 22nd to 27th, 1880.
X. from March 26th to 31st, 1880.
XI. from March 28th to April 2nd, 1880.



INTERNATIONAL METEOROLOGY—OCEAN STORM-TRACKS.

Broken or dotted lines indicate that the lines so broken are doubtful.

Arrows, when charted, fly with the wind and exhibit wind-direction.

The tracks charted in black have appeared in previous *Reviews*.

The tracks charted in red have been made from data collected since preceding *Review*.

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

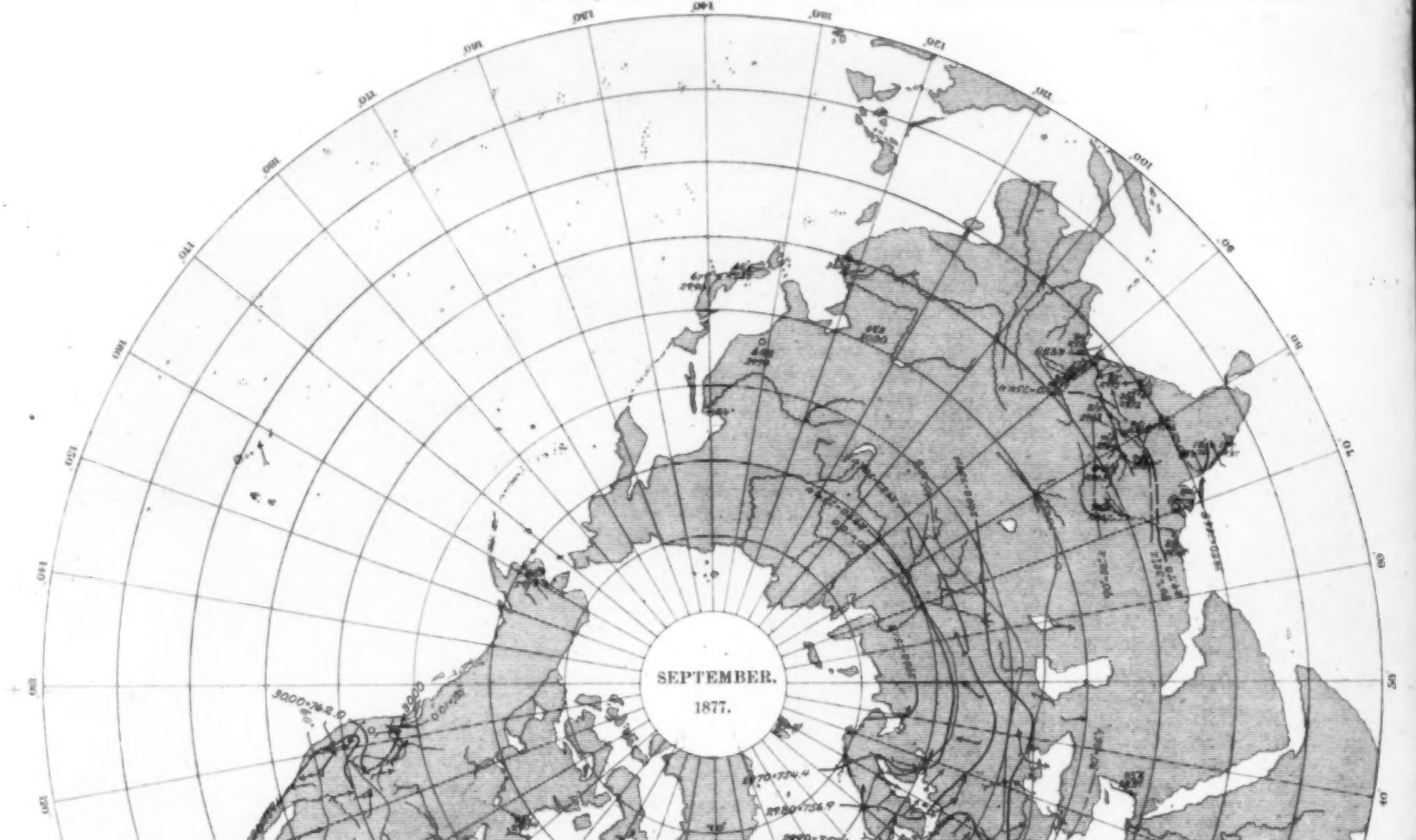
Albert J. Myer

BRIG. GEN. (BVT. ASSG'D) CHIEF SIGNAL OFFICER U. S. A.

No. V.

INTERNATIONAL MONTHLY CHART.

Showing mean pressure, mean temperature, mean force and prevailing direction of winds at 7:35 A. M. Washington mean time, for the month of September, 1877, based on the daily charts of the International Bulletin



PREVAILING WINDS.

Arrows show the direction of, and fly with, the wind. Force is shown as follows:

Symbols.	Force.	Velocity.	
		Miles per hour.	Metres per second
	1, 2	0 to 9	0 to 4.0
	3, 4	9.1 to 22.5	4.1 to 10.1
	5, 6	22.6 to 40.5	10.1 to 18.1
	7, 8	40.6 to 67.5	18.1 to 30.2
	9, 10	67.6 up.	30.2 & over.

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

Albert J. Myer

BRIG. GEN. (BVT. ASS'G'D) CHIEF SIGNAL OFFICER, U. S. A

ISOBARS AND ISOTHERMS.

Isobars in *blue*; detached barometer means in English inches.

Isotherms in *red*; detached temperature means in degrees Fahrenheit.